# Electrical Review

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**Electrical Review**

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The method of starting three-phase induction motors, described on another page, is so simple and ingenious that it deserves attention, especially in view of the importance of such a device with reference to its use in polyphase traction. The introduction of reactive coils in the rotor circuit will naturally decrease the power factor of the motor somewhat, but this is not such a serious difficulty as it seems, for the tension used between the various elements of the line may be increased a few per cent, leaving the copper required for the line at the same figure as if the power factor were unity, while the controller devices would be of the utmost simplicity.

The growth of independent telephony in the middle western states is amazing. On another page is a map of Indiana, showing the independent toll lines and exchanges in that state, and from it may be seen at a glance the size and importance of the new systems. When it is remembered that practically all of this work has been done in three years, the completeness and extent of it is astonishing. What the next three years will bring forth in Indiana, Illinois and Ohio is not hard to foresee. Those states are rapidly attaining a completeness of telephone service not approached elsewhere. It must not be forgotten that the map referred to shows the independent lines only. In addition to them is another network of lines owned by the Central Union Company, so that practically every town in the three states mentioned is connected by telephone to every other. It can not be long, if the growth of the independent companies continues, before many of these toll lines will merge into trunk systems, and really long-distance telephony will be possible over independent lines. To-day, the larger cities, such as New York, Chicago and Philadelphia, are the only places in which there is not active competition in the telephone business.

*ACTIVITY AT NIAGARA FALLS.*

There is described and illustrated in this issue of the ELECTRICAL REVIEW the progress of work on the new wheel-pit of the Niagara Falls Power Company, at Niagara Falls, N. Y., which is intended to supplement the present hydraulic installation of the same company. It is only a few years since the company began operations with a plant capable of being extended to 50,000 horse-power. Both the rapid growth of electrochemical industries at Niagara and of electric power applications in Buffalo, twenty-six miles away, have rapidly carried the plant up to the limit of its former hydraulic equipment. Now the new one, which is slightly larger than the old, is under construction and it is expected that within a year 105,000 horse-power will be generated and distributed from this one plant. The growth of such industries in the United States has been phenomenal. In New York state there is another plant under construction which will be finished within a year and will develop the enormous total of 150,000 horse-power. Practically all of the latter installation will be used in electrochemical work in the manufacture of carbides and caustic and bleaching powder. The vast water powers of the Atlantic slope, notably those of the St. Lawrence River and Niagara, have scarcely been utilized at all even by these great developments. The Niagara plant has not lowered the water passing over the falls perceptibly, and the great rapids of the St. Lawrence have not been called upon to give up more than an inappreciable percentage of their power. It does not seem rash to look forward to the northern frontier of New York state as a seat for immense industrial development as more and more use is made of the natural power existing there in the great cataract and the chains of rapids in the St. Lawrence. In other parts of the seaboard, notably in Georgia and South Carolina and in the

New England states, are other water powers which, while less imposing than Niagara, are situated in even a better climate and aggregate a total of horse-power probably sufficient to do all of the manufacturing work of the United States. To the development of these powers electricity has brought the one thing needful, which is ability to utilize the power at distant points and in ways hitherto unthought of. Advance in the art of power transmission to a distance has been so swift, and seems so far as yet from completion, that it is not unsafe to predict the coming of a time when the coast cities will be connected with these sources of power, and with mines in the interior where coal may be burned directly at the point of production and the power thus generated transmitted to the coast. As a matter of fact, the largest power transmission plants now in existence are the railroads hauling trains of coal cars. The matter of transmitting power to a great distance by electricity or by the actual transportation of coal and burning it at the point of use, is one that is determined entirely by economic conditions.

The Niagara installation was looked upon in some quarters at the time of its building as a somewhat hazardous experiment. Its complete success has justified the faith of those, both engineers and capitalists, who backed the project, and its enlargement is another proof of the capacity of communities to absorb power in the creation of new industries.

### *AUTOMOBILE WAGONS FOR HEAVY DUTY.*

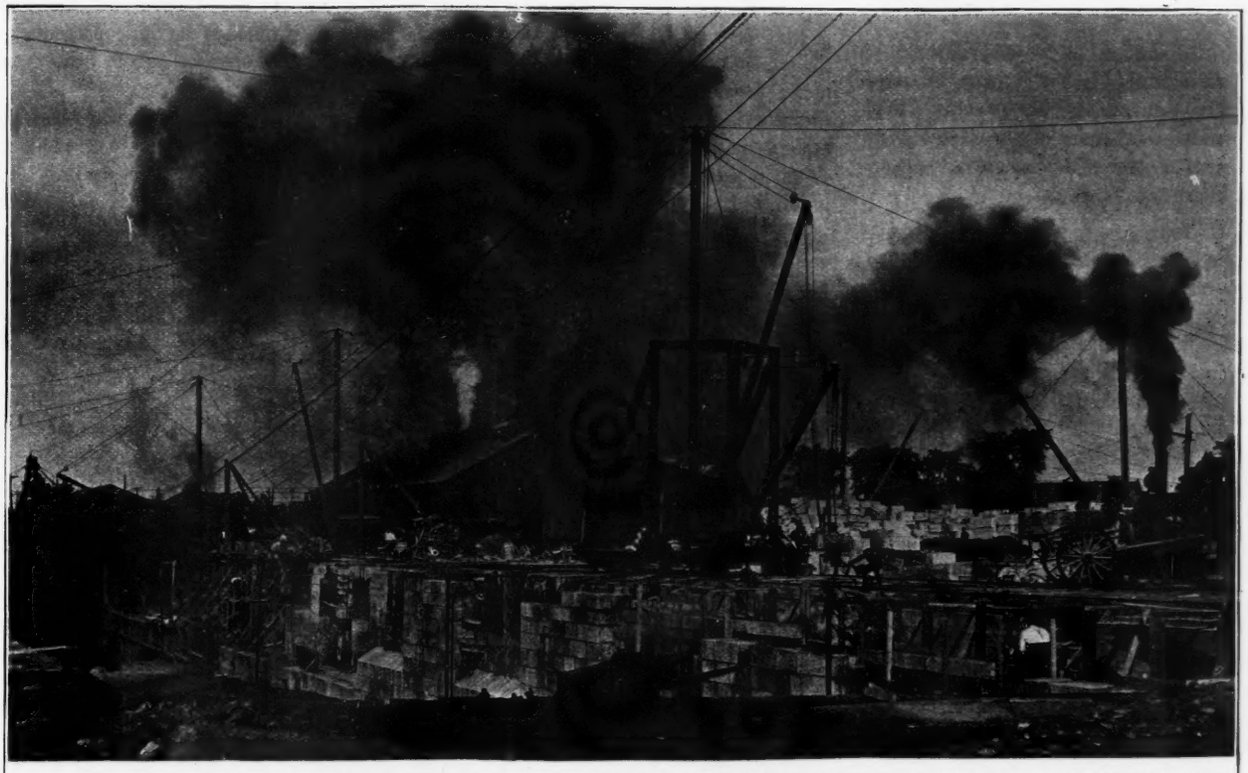
In another column is a highly interesting article by Mr. Arthur Herschmann on the subject of automobile wagons for heavy duty, such as the delivery of freight and express matter in cities. The author presents so many points of real interest and value that, while we disagree with his conclusion regarding electrical automobiles for this purpose, the article is given for the sake of the information and the data it contains.

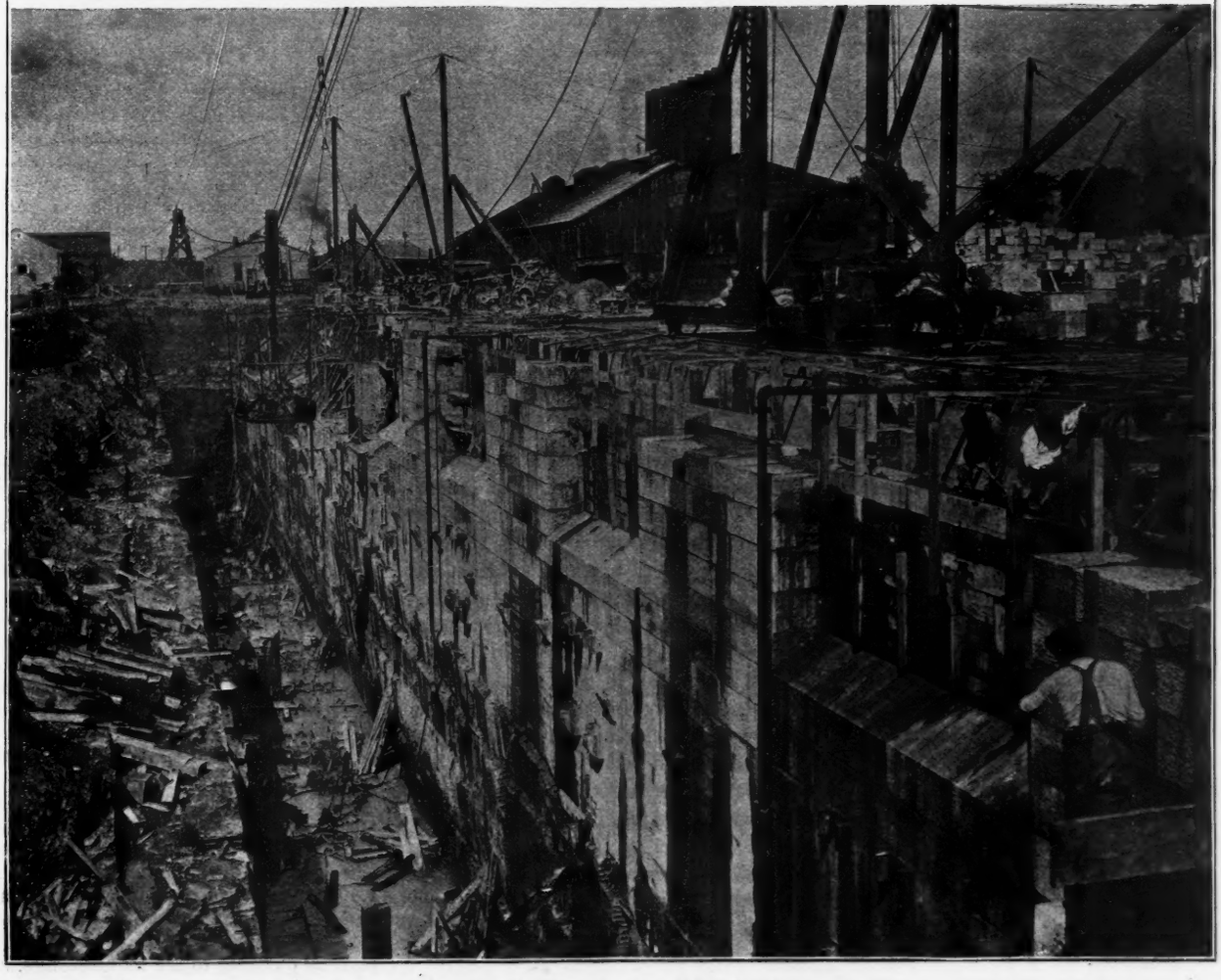
During an experience now extending over several years, the electric automobile for the transportation of passengers and light baggage as well as for the delivery of goods of medium weight from stores has proved its case in the streets of New York city. The field for merchandise delivery is practically confined to cities, the necessity for automobiles being greater as the size of the city increases and the objection to the horse becomes more and more pronounced. Of the three means for propelling automobile vehicles now generally used it is practically admitted that the only one destined to achieve final success for urban work is electricity. It is needless here to recite the disadvantages incident to gasoline vehicles or any vehicles operating by explosion motors and using some of the petroleum compounds as fuel. Their attendant odors and the danger of storing gasoline in large quantities practically rule them out for this purpose. While the steam vehicle has achieved great and gratifying success in its lighter forms, the legal situation is such that licensed engineers would certainly have to be employed to handle such vehicles, thus inviting an increased expense and possible conflict in some form with labor associations. In addition to this serious drawback, the exhaust steam, easily muffled and gotten rid of in a light pleasure vehicle, would become a problem of considerable importance in a large and powerful steam wagon, and the practical necessity for the use of inflammable oils as fuel would meet the same objections as those cited above for the explosion motor form of automobile. The place for the steam motor is on the railway track and not in the street.

On the other hand, every conceivable advantage of ease of management, perfection of power application and freedom from nuisance is inherent in the electric automobile. It is true that its weight is great and that its first cost is high, but it has been demonstrated that it earns interest on its cost and the question of weight is one that needs give little trouble. The streets are strong enough to support heavy weights running on wide wheels, and the battery is sufficiently powerful to move itself and its load. So far, while there have appeared no designs of electric trucks on a large scale for heavy freight delivery wagons, many of them of fairly generous proportions have been illustrated in the ELECTRICAL REVIEW, including medium class trucks for the transportation of pianos and other moderately heavy merchandise. These vehicles have been successful as their increasing use completely demonstrates. They are being made as fast as a number of manufacturers can turn them out and are finding employment in the streets of nearly all the large cities of this country. The problem of transportation for freight through the streets of cities like New York present elements of the most peculiar interest for the engineer. It does not seem rash to state that the present system of trucking, with straining horses slipping and falling, and too often brutally lashed to put forth their last endeavors, is bound to disappear in a few years. It is unprogressive and practically an anachronism. There has been no advance in the art of trucking and teaming with horses in a century, and practically none since the invention of spring wagons. The horse must go, at least from city streets; his place is in the country and in the little traveled streets of rural villages. There is no longer room for him or the dirt, the odors, and the flies that his presence entails in such crowded congregations of humanity as New York and other cities of the first class.

Somebody wrote recently in a newspaper that very few electromobiles were to be seen at race meetings, meaning horse-race meetings. From this he argued that the popularity of that type of vehicle is on the wane. He omitted, however, to take into consideration the fact that tastes differ, especially among the various classes of the community. The fact is that electric vehicles are more popular than they ever were before, but the class of people who own private vehicles of this sort are not particularly interested in race meetings; they are to be found in great numbers at such places as Newport and Bar Harbor, but the betting ring of the Coney Island track knows them not.

Presence of mind, speed of action and good control of the nerves in emergencies are absolutely necessary to the automobilist. Happily, the electromobile lends itself readily to the display of these qualities; hence, accidents are rare.





1.—General View of the Work on the New Niagara Falls Wheel-Pit, Looking Toward the Compressor Plant.
2.—The Wheel-Pit, Showing Operation of Cableway, Masonry, and Method of Placing Castings in the Walls; also Channeling of the Sides (See page 148.)

## THE NEW WHEEL-PIT AT NIAGARA.

THE NIAGARA FALLS POWER COMPANY'S EXTENSION OF ITS POWER PLANT—THE GREATEST EXCAVATION EVER MADE — ELABORATE TRANSPORTING AND CONVEYING MACHINERY—PROGRESS OF THE WORK.

BY ORRIN E. DUNLAP.

It was in November last that the National Contracting Company commenced the construction of the new wheel-pit for the Niagara Falls Power Company. When ground was broken it was expected that 20 months would be consumed in carrying out the contract, and from the progress made there is every reason to believe that the big job will be finished in that time, or by June, 1901. The dimensions of the pit when finished will be 463 feet 1 inch between channel cuts, 16 feet wide below the turbine deck and 17 feet 4 inches wide above the deck, while the depth will be approximately 180 feet. The conditions under which work has been carried on since ground was broken have been favorable, and the present depth of the pit is 75 feet. Night and day shifts are employed on the contract. Night work is facilitated by 10 arc lamps placed in the pit and by a Wagenhall electric headlight erected on a tower 30 feet up from the ground at one end of the pit, it being possible to throw the beam of this headlight wherever most desired.

Over the pit, extending from end to end, there has been placed a Lidgerwood patent cableway, the cable of which is 2½ inches in diameter and capable of raising 10 tons. This cableway is operated from towers built at each end of the big hole. One of these towers has a height of 30 feet while the other is 60 feet high. The bucket on the cableway holds two cubic yards, and the appliance has the aerial dump feature, all governed in operation by the engineer located in a small building close to the big tower. When the bucket is full of stone, it is raised out of the pit and run along the cableway to a point near the high tower, where it is lowered to Goodwin gravity dumping cars, into which the excavated material falls. In the dump cars the rock is carried to the trestle of the Niagara Junction Railway, where it is employed in building a roadbed to make possible the double tracking of the line in the near future.

On the south side of the pit the masonry wall at the top is quite well advanced, and as this work is done the castings for various purposes are placed in position. These castings are quite massive and of several shapes. They will be used for supporting bearings, struts and the penstocks, their placing in the walls requiring the nicest possible adjustment. All blasting in the pit is done at off hours, and dynamite is employed in such quantities only as not to endanger the installations in the present pit and power station.

When the new pit is completed there will be placed in it eleven units of 5,000 horse-power each, making a total output capacity of 55,000 horse-power, which, with the 50,000 horse-power available from the present plant will give the Niagara Falls Power Company a total output capacity of 105,000 horse-power from the two pits. While it has been announced that the Niagara Falls Power Company would make changes in the form of the turbines to be installed in the new pit, the exact nature of these changes has not as yet been made public, the engineers being still at work on the plans and details. It was on this subject that Dr. Coleman Sellers and Resident Engineer William A. Brackenridge went to Europe to consult with the designers of the original turbines. All matters relating to the installation are worked out with the greatest detail and facts about it are not stated until every feature has been decided upon, the Niagara Falls Power Company preferring to tell what has been done rather than that which is prospective. A change at certain points must of necessity create or cause changes at other points, and for this reason the details are most carefully studied.

In the inlet canal in front of the new pit site a big cofferdam has been completed. This is 550 feet long, and is made of an outer and an inner crib, both stone-filled, between which there is a clay puddle. The purpose of this cofferdam is to keep back the waters of the canal during the time the inlets are being built in connection with the new pit. Thus it will be seen that the water supply for the turbines of the new pit is to be taken from the present inlet canal, a feature provided for when the canal was originally constructed.

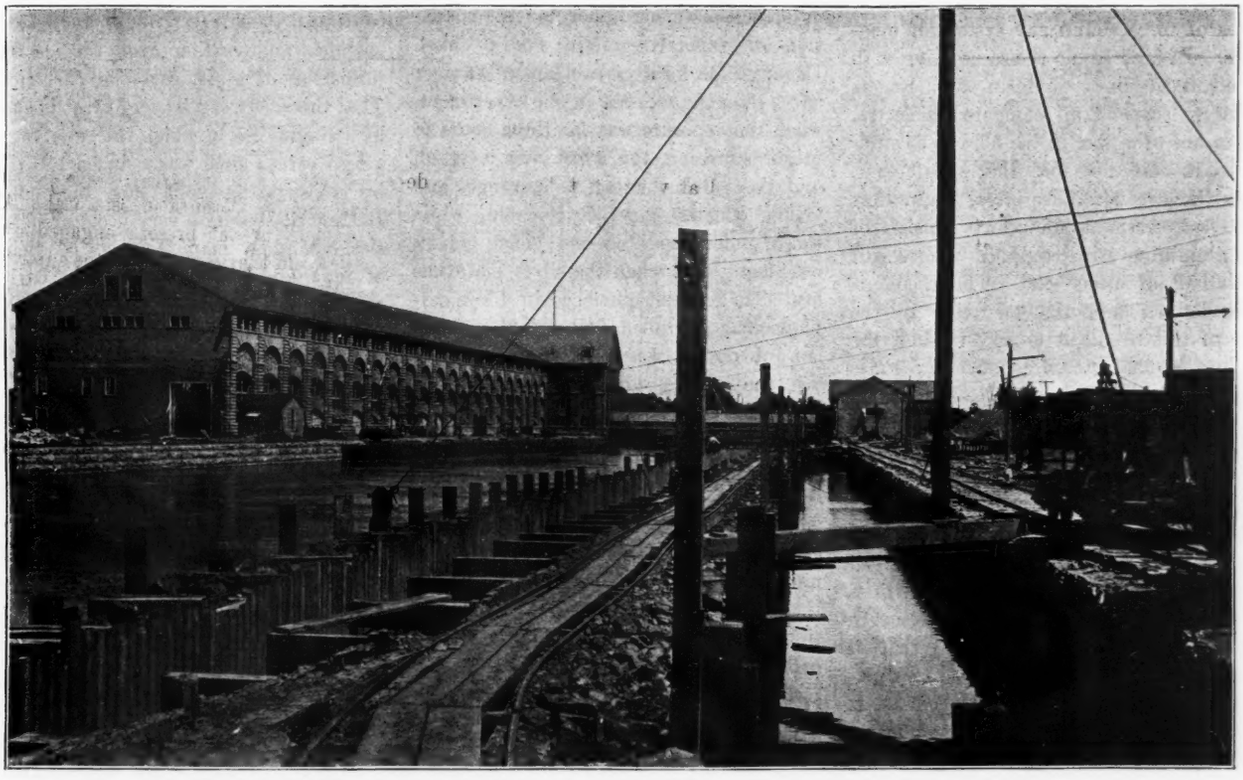
The shaft sunk to the tunnel heading at a point in the inlet canal in front of the power house has been completed, and the tunnel extension work has proceeded all of 200 feet. This portion of the work has been sublet to A. C. Douglass by the National Contracting Company, and his method is to remove the upper bench of the section first. The excavated material is raised out of the tunnel and shaft by means of a derrick and disposed of in a manner similar to the muck from the pit. About the mouth of the shaft masonry walls are being constructed to protect the opening from the canal waters.

To stand at a point near the high tower and take a general look about the scene of operations is to get an impressive view. On all sides there is the greatest activity, and great piles of material to be used are lying all about. Across the pit, from the stacks of the boilers in the compressor plant huge clouds of smoke roll, telling that the forces are at work to keep up a full and constant supply of compressed air for the drills, etc. Piles of granite to be used in the masonry command attention, and locomotives are running here and there in performing their part of the contract. The Byer's traveling derrick is seen picking up a huge block of granite and swing it around to be placed in the wall that grows day by day, slowly but surely, but with a strength that makes it most substantial. About 400 men are at present engaged on the work, and they come under the supervision of Mr. Walter McCulloh, who is the local manager or resident engineer of the work for the National Contracting Company. The consulting engineer of this company is Mr. George B. Burbank, who at the time of the construction of the tunnel was the chief engineer of the Cataract Construction Company. Resident Engineer William A. Brackenridge looks after the interests of the Niagara Falls Power Company in the great work. He has had wide experience in Niagara construction and is familiar with all its remarkable features and demands.

It is when one takes into consideration the enormous amount of material to be handled that the extent of the contract is most fully realized. It is a good deal to say that this is the largest hole ever broken into the earth at once, but then the contract of the National Contracting Company calls for something else besides excavation. There are the brick lining walls to be placed, the masonry to be erected, the castings to be placed, the walls to be channeled, and all this and much else to be done so that the completed work may be classified as perfection in all parts. From the pit and inlets 32,000 cubic yards of dirt are to be taken. From the wheel-pit 68,000 cubic yards of rock will come, and 13,000 cubic yards from the shaft and tunnels. Of Portland cement concrete 10,000 yards are to be used, and the brick work calls for 13,000 yards, or the laying of 7,500,000 brick. In the masonry 6,000 yards of cut stone are to be placed, and in the cofferdams 800,000 feet of hemlock have been used. The castings, pipes and girders call for 1,400,000 pounds of iron and steel, and in addition to this there is the extensive construction plant to be provided. This plant is quite up to the requirements, and all its features are working satisfactorily.

### A Large Power Installation in Sweden.

A large installation for transmission of power has been constructed at the Trangfors waterfall, at Vöstmanland, Sweden. The Kolböck River there forms a waterfall of about 33 feet in height, and the installation comprises six quadruple turbines with horizontal shafts, each of 300 effective horse-power, with 250 revolutions per minute. The shafts are direct coupled with the electric generators. The whole river has been dammed, and from its north side, the water passes through a canal 1,130 feet long, 23 feet broad at bottom, with 8-foot depth of water, and sloping sides, to the power station, which is 113 feet long and 50 feet wide. The floor of the engine room is 10 feet above the lower surface of the water, and the shafts of the turbines are located four feet above the floor. The turbines are radial, each with four wheels of 700 millimetres in diameter. The water is led to the turbines through three pipes of eight feet in diameter. At the end of each tube is a small turbine for working the exciters, which are common for the two generators. These turbines also have horizontal axes, and are each of 25 effective horse-power, with 560 revolutions per minute; they are otherwise of the same construction as the larger ones, and direct coupled with the exciters. These turbines utilize from 60 to 80 per cent of the natural power. The current from all six generators is collected and afterwards conveyed to 18 transformers, where the tension is raised from 800 to 14,000 volts. The transmitting line consists of three 6.75 millimetres copper wires, supported by porcelain insulators attached to poles placed at a distance of 166 feet; the poles are of a height making the minimum distance from the lowest wire to the ground 27 feet; lightning dischargers are placed at both ends of the line. On reaching the boundaries up the town of Vesteras, a distance of some 14 miles, the tension is again reduced through the same number and size of transformers, and distributed to the various consumers. The Northern Metal Company heads the list of the consumers, their new works requiring no less than 900 horse-power, divided among 14 motors, varying from 300 to 3 horse-power capacity. The motors are all inductive, and the large ones are principally used for the working of rolling mills. Special and thoroughly practical appliances have been installed for facilitating the starting of these heavy motors. The works of the General Swedish Electric Company receive 300 horse-power, part of which current is used for direct driving of inductive motors, while another portion is transformed in small, portable transformers to work a large number of small motors. The power station belongs to the Trangfors Power Company. The water power and the site of the station have been leased for a period of 50 years from the owners, the Hallstahammar Company, Limited.—*Engineering.*



THE GREAT COFFER-DAM IN THE INLET CANAL OF THE NIAGARA FALLS POWER COMPANY.

### PERSONAL.

Major George W. LaRue one of the pioneer electrical men of this country, sailed from Philadelphia a few days ago for a continental tour.

### The New Germany-Azores Cable.

The cableship Anglia arrived at New York last week and will proceed as soon as possible to lay a cable from Coney Island to the Azores. The cable between Emden, Germany, and the Azores is already laid and in operation. The entire cable is expected to be ready for service about September 15. The American end will be operated by the Commercial Cable Company, and the European end by the German Telegraph Administration.

### Aluminum Works Destroyed.

A press telegram from Pittsburgh says that at New Kensington, Pa., on Sunday, August 12, almost the entire plant of the Pittsburgh Reduction Company's aluminum works was destroyed by a tornado. The loss is estimated at $100,000, and the calamity will entail the closing of the works for an indefinite period. Frank Johnson, engineer, was caught by the falling walls and probably fatally injured. Fortunately few of the 250 employees are at work on Sunday. The company's plant covered almost 10 acres on the banks of the Alleghany River.

# SCIENCE BREVITIES

**Electrostatic Lines of Force**—Mr. F. J. Rogers describes in the *Physical Review* an electrostatic needle to be used for the exploration of electrostatic lines of force. When teaching students electricity, it is always advisable to show them experiments which give a physical representation of the phenomenon which has to be mastered. For instance, with lines of magnetic force, the students can easily produce for themselves with paraffined paper and iron filings the contour of the lines of force round any system of magnets. In order to do the same thing with electrostatic lines of force, Mr. Rogers tried to suspend an elongated dielectric by means of a fiber in the field to be studied. He did not find this satisfactory, says the *Electrical Engineer,* but prefers an electrostatic needle which consists of an aluminum wire equipped with a gilt pith ball at either end. The needle is mounted on an horizontal axis. By the aid of this needle it is easy to show the following characteristics of electrostatic fields: (1) that lines of force are normal to the surface of a charged conductor (an elongated cylinder for example); (2) that lines of force are not normal to the surface of a hard rubber rod, one end of which has been charged by friction; (3) that in the case of two oppositely-charged conductors placed near each other the lines of force issue from one conductor, curve over, and end on the other; (4) that in the case of two similarly-charged conductors the lines of force from each leave it normally and pass out into space, none of them passing from one conductor to the other. A much more useful form of electrostatic needle is constructed as follows: In place of the aluminum wire a small rod of hard rubber is used. It is mounted on a shaft and provided with pith balls, as in the first form. The pith balls are oppositely charged by contact with the poles of an electrical machine. While so charged, the electrostatic needle behaves in an electrostatic field just as a magnetic needle does in a magnetic field.

**Unexplained Phenomena**—There have been for years certain actions of light on metallic surfaces which have not been explained on theoretical grounds. Amongst these are the actions of light noted by Moser some 60 years ago. Major-General G. Waterhouse, has during the last year, been investigating the phenomena first recorded by Moser, says the London *Electrical Engineer.* From these investigations he confirms Moser's results as to the production of a change on the surface of metallic silver by exposure to light that can be demonstrated by the condensation of a vapor such as mercury upon it. But he has gone further, and demonstrated the change by the deposition of silver from solution, after the manner of the development of an exposed wet collodion photographic plate. By some half-hour's exposure in bright sunshine "printed out" images were obtained —that is, images visible without any subsequent application of a developer. General Waterhouse shows that these results are not due to pressure against the mask or stencil-plate used, nor to the emanation of vapors from it, nor to heat. Usually blue light gives a much stronger effect than the red, but in one experiment, when the exposure was for three hours to bright sunshine, the effect was reversed, and the patches under red, orange, and yellow glasses were developable, while those under the blue and violet glasses were not. But when the silver plate was heated to redness, quenched in dilute sulphuric acid, washed and dried, and the cut-out design was also warmed before use, the effect produced by light was so small that it seems doubtful whether there was any effect at all. On the other hand, if the silver plate was exposed to the fumes of certain substances, especially nitric acid, it was rendered very much more sensitive. General Waterhouse, in his communication to the Royal Society, states that he hopes to continue the investigation this Summer, and invites others to extend the observations that he has described.

**Change of Resistance by Magnetization**—The influence of magnetization upon the resistance of a wire has not yet been studied with the care which the importance of the subject demands. Electromagnetic theory can not but be greatly affected by any facts which are elicited, and the influence of changes in the earth's magnetic field upon magnetic conductors may be of some practical interest. Results attained in the case of bismuth would seem to indicate that there is no connection between magnetization and change of resistance. But Messrs. A. Gray and E. Taylor Jones have been led to the opposite conclusion by the results of some experiments on soft iron wires, thus abstracted by M. Fournier d'Albe: They determined simultaneous values of the magnetizing force, the magnetization, and the resistance. To equalize the heating effects, they wound two identical lengths of the same wire on the same core, one longitudinally and the other transversely, and inserted the compound coil in the interior of a magnetizing coil. The transverse coil was of course only very feebly magnetized. Both wires were traversed by the same current, but the longitudinal coil always showed the greater increase of resistance, the difference between the two fractional increments being about $3 \times 10^{-4}$ in a field of 30 units, and $15 \times 10^{-4}$ in a field of 300 units, and change of resistance appears to be proportional to the fourth power of intensity of magnetization.

**Electric Properties of Different Glasses**—Messrs. A. Gray and J. J. Dobbie have continued their researches on the effect of chemical composition upon the electrical properties of glass, says the *Electrician.* That this effect can be very great is shown by a single case in which the resistance of a lead potash glass was reduced 130 times by substituting soda for the potash. Barium glasses have very peculiar properties. A glass manufactured by Schott, of Jena, and composed mainly of barium, oxide and alumina in combination with silica and boron trioxide, has a very high resistance, one quite unmeasurable, indeed, within the range of temperatures commanded by the authors. Moreover, the inductive capacity in a plate of this glass is exceedingly low, and the glass shows little or no effects of dielectric polarization. The authors thought that the barium might be the determining factor in the high resistance. But a barium potash glass made by Powell & Sons showed comparatively a very low resistance, which is exceeded even by ordinary commercial lead glass. The effect of annealing glass is greatly to increase the resistance, often to three times its original value. An annealed lead potash glass, containing 48 per cent of silica and 41 per cent of lead oxide, had a specific resistance of over 29,000 by $10^{10}$ ohms at 140 degrees, and a dielectric constant of over 7.42. The resistances were studied by the method of flasks filled with mercury.

**Thermo-Electricity of Nickel Steel**—The announcement of the high thermo-electric force of nickel steel containing 28 per cent of nickel having given rise to some doubts, M. C. E. Guillaume forwarded an authentic sample of such steel to Herr E. Steinmann for redetermination. The latter announces now that the phenomenally high value of — 2,461 microvolts with reference to lead is not shown by the authentic specimen, which only shows 385 microvolts, says an *Electrician* abstract. The old specimen turns out to have been wrongly labelled. It should have been marked as containing 36.1 per cent of nickel.

## ARRANGEMENT TO PREVENT INTERCEPTION OF DESPATCHES IN WIRELESS TELEGRAPHY.*

BY DR. D. TOMMASI.

We know that wireless telegraphy is open to the objection that it does not ensure secrecy in the messages sent, since any receiving apparatus placed within the zone of action of the electrical waves emitted by the transmitting apparatus may be influenced by them, and can consequently intercept the messages sent.

The object of the arrangement that I have designed is to prevent a message sent out by the transmitting apparatus of a telegraph station from being deciphered by a receiving apparatus placed at an intermediate point.

My invention is based on the fact that the distance to which the electric waves can extend varies according to whether the two metallic spheres of the oscillator are near together or not.

It follows, therefore, that by suitably varying the distance between the two spheres, *i. e.*, by increasing or diminishing the length of the spark of the oscillator, we can regulate pretty accurately the distance which the electric waves will have to cross in order to reach the receiving station of the line.

My arrangement consists in principle in combining the transmitter of the overhead line, which I will call A, with a second transmitter, A′, the manipulator of which, however it may be worked, sends out long and short emissions, which mingle with those of the transmitter, A, and the oscillator of which is so regulated that the zone of action of the waves sent out by the transmitter, A′, extends to a distance slightly less than that for which the oscillator of the transmitter, A, has been regulated.

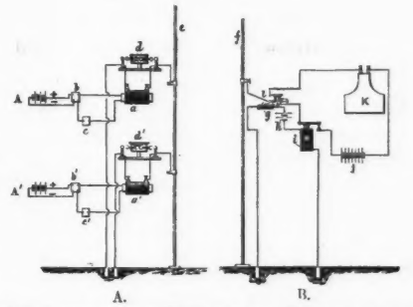
Under these conditions the electric waves generated by the transmitters, A and A′, are so blended with one another that any receiving apparatus placed within the zone of action of A′, would only receive a confused quantity of dots and dashes from which it would be utterly impossible to eliminate the signals sent out by the transmitter A.

It will, therefore, only be possible to receive the signals sent out by the transmitter A, outside the zone of action of the transmitter A′. The more nearly the zone of action of the transmitter A′ corresponds with that of the transmitter A, the greater will be the security from interception. In order to obtain still greater immunity, we could combine with the actual transmitter, A, of the line, several transmitters, A′, A″, A‴ . . . . regulated for various distances.

As shown in the accompanying figure, the complete telegraphic apparatus comprises a transmitting station A, and a receiving station B.

The station, A, which constitutes the actual transmitter, consists of an induction coil *a*, on the primary circuit of which are introduced the interrupter *b*, and the manipulator *c*, with the secondary current ends at the terminals of the oscillator *d*, which communicates with the earth, and is connected with the mast *e*.

This station, A, contains besides a second transmitting apparatus A′, consisting of the same elements as the first; *i. e.*, of




CONNECTIONS FOR PREVENTING INTERCEPTION OF WIRELESS TELEGRAMS.

an induction coil *a′*, with an interrupter *b′*, a manipulator *c′*, and an oscillator *d′*, connected like the first with the mast *e*.

In this second transmitting apparatus the manipulator, *c′*, may be worked in any manner whatever, either by hand or mechanically, so as to send out at random long and short signals which will mingle with the signals transmitted by the manipulator *c*.

The manipulator of the second transmitter, A′, can also be kept lowered during the whole duration of the transmission of the message by the real transmitter, A, so that any receiver placed within the zone of action of the second transmitter, A′, will merely register a single continuous line. The space between the spheres of the oscillators, *d*, is regulated so that the electric waves sent out by this apparatus will reach the receiving station B; but on the contrary, that of the spheres of the oscillator, *d′*, is arranged so that the zone of action of the electric waves sent out by the latter shall be slightly smaller than that of the waves sent out by the transmitter of the actual oscillator A. Under these conditions, any receiver placed within the zone of action of the second transmitter can only collect, as has already been said, a series of dots and dashes from which the signals of the actual transmitter, A, can not be deciphered.

The receiving station consists, as usual, of a receiving mast *f*, similar to the mast *e*, connected with a coherer, *g*, the electrodes of which are connected, one to earth and the other with a circuit passing through a battery, *h*, and a polarized relay, *i*, the function of which, when the coherer, *g*, is rendered conductive by the action of the electrical waves, is to close the circuit of a local battery, *j*, working a registering receiving apparatus, *k*, and the electric clapper, *l*, which is intended to bring the coherer back immediately to its original resistance.

* From the London *Electrical Review*.

### Electrolysis Investigations in Providence, R. I.

Mr. A. A. Knudson has been investigating the subject of electrolytic corrosion of water and gas pipes in the city of Providence, R. I., on behalf of the water department and the commissioner of public works, so that specifications of alteration in the return circuits of the Union Railroad Company might properly be prepared by the city authorities. Over a considerable portion of the city tests were made, 123 potential tests being made between water mains and rails, and a large number of tests at each of 15 different locations, in order to determine the condition of rail bonds and their efficiency at turn-outs, switches, etc. Eleven excavations were made for the examination of the outside surface of water mains.

It was found that a 24-inch water main in Smith street, lying about three and one-half feet under the tracks for a distance of more than two miles, was carrying a considerable amount of the return current, and examination of this pipe showed electrolytic pittings on the positive sides of the joints. On a turn-out, a bond was found that had been broken off at one end and corroded at the other. Broken bonds were found to be a source of local trouble in several places. On the Hartford avenue line readings as high as 21 volts were taken and a search for the cause of the trouble showed that bonds had been cut when rails were separated in laying a sewer and had not been replaced. By connecting these rail ends the reading was reduced to eight volts. As a whole, the condition of the water pipes in the city, while not healthy, was not found to be critical, and it is likely that the measures which will be taken by the street railroad company will effectually overcome the difficulties that have been noticed. Mr. Knudson's report is very full and is illustrated with numerous photographs made by the author and showing the appearance of the uncovered pipes, rail bonds, etc.

## REGULATION IN LONG-DISTANCE TRANSMISSION.*

BY FREDERIC A. C. PERRINE.

When we speak of the regulation in an electric plant of any kind, it is common to refer only to the maintenance of the proper voltage at the lamps or the motors of the customers, but in order that a proper system of distribution in the regulation for the customer be obtained, it is necessary in the design of the plant to consider regulation at many different points and of several different kinds in order that the service offered may be perfectly satisfactory. In the first place, the periodicity of an alternating-current supply, must be maintained constant, which means that the water wheels must be adapted with regulators which will produce a constant speed of running, irrespective of changes in the load and changes in the voltage. Passing the water wheels and approaching the generators, we find that here the regulation is one of voltage, and that in the generating station the voltage must vary with varying load, even though the customer may require a voltage as constant as the periodicity. The step-up transformers in the generating station are involved as one of the factors which determine the amount of voltage variation which the generator must provide, and passing these transformers we find in the line a disturbing element that must be carefully considered, even though at its end a voltage as nearly constant as may be must be attained. The final adjustment of the voltage to suit the customers needs is provided in the sub-station where the step-down transformers are located.

It is the writer's purpose to call attention to the difficulties of regulation at each one of these points and to point to general solutions in overcoming such difficulties as may be presented without trying to offer the definite solution in any particular case. This discussion, therefore, may serve merely to make the ideas already familiar to us all more concrete, and to call attention to a few neglected conditions in obtaining a perfectly satisfactory service.

As has already been said, the regulation of the water wheels must be such as will maintain constant speed, and such constancy is obtained in a different manner with high and low head wheels. With wheels operating under a low head of water, large penstocks in which the water moves at a low velocity are generally available, and, in consequence, regulation of such wheels is always provided by variation of gate opening. This system of regulation, while certainly difficult to accomplish on account of the weight of the moving parts, is ideal in respect to conservation of water, the water allowed to flow being in some respect proportionate to the load. We say "in some respect," on account of the fact that the efficiency of all water wheels falls very materially as the load decreases. This difficulty of efficiency variation produces a difficulty in regulation, for the reason that a certain load change at full load requires a smaller gate variation than the same load change at one-quarter load, and in order to surmount this difficulty a recent Italian designer has attempted to close bucket openings in place of the gate openings in his wheel, thus operating certain buckets always with full volume of water and maintaining full bucket efficiency at all loads.

Such wheels have not been built in this country, although a set has been contracted for by the Montmorency Electric Power Company, at Quebec, where the wheels under this design are now being installed.

The good regulating points of the low head wheels are sacrificed whenever the velocity of flow or the length of a column in the penstocks is increased, and their regulation is correspondingly improved by shortening the penstocks, even to its entire obliteration, and operating the wheels in the forebay itself.

However obvious this may seem, it is nevertheless the fact that in an eastern plant recently installed and not yet in operation, the engineers have led the water from the forebay through 160 feet of entirely unnecessary penstocks laid level.

Low head wheels are of far less importance to the members of the Pacific Coast Electric Transmission Association than are those operating under high heads. The characteristic of a high head plant, differing from that of a low head plant, is that the penstock, instead of being short, of large diameter and of low water velocity, is long, of comparatively small diameter, with the water velocity rising as high as 12 to 15 feet per second. From this condition results that any attempt to regulate the wheels by varying the flow of water produces fluctuations in the pipe which are not only difficult to resist mechanically in pipe construction, but also are most disastrous to attempts at regulation, since the curve of efficiency of the high-head water wheel varies much more rapidly from full load to one-quarter load than the curve of efficiency of the low-head wheel; and, furthermore, any attempt at closing the water gate at the end of a long pipe in which the water is flowing at a high velocity is resisted by the water within the pipe with a tendency to momentarily maintain the same energy without much reference to the size of the opening. The effect of varying the opening in the water gate is to vary the velocity of the water flowing through it, and, as the energy is equal to one-half the mass times the velocity squared, the variation of velocity tends to maintain a constant amount of energy imparted to the wheel in spite of the variations in the mass. In a station operating more than one wheel from the same pipe line, this effect is distributed among all the wheels running, and it is often possible by closing one gate partially to speed up all wheels for an instant, the wheels only attaining the proper speed due to the reduced opening after they have been subjected to a series of impulses from the surging water within the main pipe. In one case to which the attention of the writer was called, where wheels were operated under about 250 feet of head, closing of a single gate at the power house would cause the water to rise in the forebay as much as 10 feet, which rise was necessarily occasioned by variations in pressure equal to about 10 per cent of the full pressure at the power house. Furthermore, it is hardly to be conceived that any throttling nozzle that has been devised can prevent leakage and prevent eddies of water on the back of the bucket producing disturbances of the speed regulation. In consequence of these facts, it seems to be the clear conclusion that regulation of high head wheels can be best obtained by a system which does not disturb the flow of water in the pipe line, which points either to the deflecting nozzle or the deflecting hood, and while we have no tests of the two systems which are thoroughly reliable, it certainly seems that the undistorted stream from a deflecting nozzle should give higher wheel efficiency at partial loads than will the distorted stream produced by a deflecting hood. If either of these systems is to be used, the plant should be so installed as to reduce the wastage of water at partial loads as far as possible, since, of course, with a deflecting nozzle or deflecting hood, the flow of water through the nozzle is always constant. Such a sub-division, therefore, of the water wheel units is necessary as will allow cutting out of entire wheels when the load shall vary materially. It is not the desire of any engineer to install small generating units which this system of regulation seems to entail, but the same result can be obtained by a multiplication of the number of wheels attached to each generating unit. Up to the present time no more than two wheels per generator have been installed in any high head plant, though in certain low head plants as many as five or six wheels have been attached to one generator. Should high head plants be installed with as many wheels as this, the cost of the entire plant could be kept down by increasing the speed of the generators very materially. In fact, for units as large as 1,000 kilowatts, a speed of from 600 to 1,000 revolutions should be readily attained and the cost of such a plant with five or six wheels on the generator shaft would not be greater than the cost of a plant with one wheel running at about 200 revolutions attached to a generator of the same capacity.

When we pass from the water wheel to the generator, we find that while the water wheel must regulate for constant speed, the generator, which is operated at the constant speed of the water wheel, must be adapted for variable voltage regulation. In specifying generators it is far more

* A paper read before the Pacific Coast Electric Transmission Association, June 19, 1900.

common to demand extreme self-regulation as regards constant voltage than it is to demand a possibility of great voltage variation, whereas in the generating station the machine must necessarily be varied in voltage even though a constant voltage be demanded by the customer, and in consequence, machines that are designed for self-regulation of constant voltage are not generally satisfactory in long-distance transmission plants. This is especially true on account of the fact that it is the custom authorized by the standardizing rules of the American Institute of Electrical Engineers to measure the regulating properties of the generator on a non-inductive load. A non-inductive load in a long-distance transmission plant is an impossibility, for even though the plant be used only when furnishing a non-inductive load, as of incandescent lights, the lines and transformers introduce at the generator a reactance which must be taken care of by the design of the machine. Indeed, the extremes of reactance are always encountered in such plants, since at low loads the long lines will make the generator current lead; at high load they may lag very materially. In consequence of these facts, the inductive regulation of the generator as such must be as high as possible, though the ohmic resistance of the machine need not be necessarily low, as would be the case for a close self-regulating machine operated on a non-inductive load; and many generators acceptable in power stations for the reason that under the conditions of non-inductive operation very close self-regulating properties are unsatisfactory in long-distance plants, both for the reason that they will vary in voltage greatly when inductive loads are applied, and, furthermore, they have not sufficient margin of field capacity to permit of over-excitation necessary for overcoming the effect of the lag factor. In consequence, the capacity of both the field and the armature must be higher than is commonly allowed, or else under the common circumstances of running, the machines will not be able to use within 10 or 15 per cent of the full energy delivered by the water wheels. It is not often acceptable in long-distance transmission plants that the generators should have a possible voltage regulation equal to the full amount of the line loss, but they must be designed to permit from two to three times the voltage variation determined by the losses in the lines. It may seem anomalous to state in the beginning that the machines need not be designed for close self-regulation and in the end that their inductive drop must be smaller, but when it is remembered that close self-regulation may be produced by low ohmic resistance, which is unnecessary for small inductive drop, the anomaly is explained. A complete discussion of this effect was given by Professor Cory last year before the association.

The same observations are true of the step-up transformers; this, also, having been called to the attention of the association last year by the writer in discussion of the experiments at Stockton. The only essential difference between the transformer effect and the generator effect being that while the regulation of the generator on non-inductive load can be about one-third the regulation of the transformers on an inductive load, it seems to be impossible to design a generator better than about one-fifth as good regulation as the best transformers, though the writer's observations last year on transformers show that while a transformer designed for two per cent non-inductive regulation may give a 10 per cent rise in voltage on a leading current, it has been found that transformers with the same non-inductive regulation can be designed to give a voltage rise, under the same conditions, not over one-quarter as great; and, furthermore, as the machine must compensate for the voltage regulation, both within its own coils and also within the coils of the step-up and step-down transformers, as well as throughout the whole line, it follows that the transformers should be designed to relieve machines as far as possible of great necessity for variation as the inductive effect of the load changes. In consequence, the specification of the inductive drop through a transformer is, in general, more important than a specification of the non-inductive regulation.

Perhaps the worst disturbing effect of all is to be found in the line itself. Here we have not only an inductive drop, but also a heavy capacity current, the capacity current remaining practically constant at all loads while the inductive drop varies with the load. The question for the proper disposition of the line to have the capacity current from the line counteract entirely the various reactances throughout the circuit, is a very alluring one and has been tried by many designers; but as the capacity current remains constant while the reactance continually varies with the load, it is impossible to so adjust the line in height above the ground and distance between wires as to effect any serviceable self-regulation. If self-regulation consisted in the maintenance of a constant voltage at a constant load, the line might be so designed as to aid in producing this effect, but as the load falls the importance of the leading current in the line becomes greater, while as the load rises its importance diminishes, in both cases disturbing the voltage and demanding from the machine a wide range of possible manual regulation. Until recently, the exact effect of the line as regards both capacity and inductance, proved to be a difficult problem presented for solution, though, of course, the solution could be accomplished by several methods on devoting a sufficient amount of time. This problem is one that has given the writer much labor, and it was with pleasure that in conjunction with Mr. F. G. Baum, he was able to present before the American Institute of Electrical Engineers this year a simpler solution for the regulation of a circuit for any character or changes of load, taking into account not only the questions of the load and transformers, but also the line. The line itself limits the amount of power that can be transmitted to a great distance, for the reason that for a line of about 100 miles in length, with voltage between 40,000 and 50,000, from 1,200 to 1,500 kilovolt amperes must be used in charging the line—unless reactance coils are used—and, in consequence, an amount of power less than 3,000 horse-power can not be satisfactorily delivered such a distance, even where the selling price of power should be enough to counterbalance the cost of the line of such a length, the large capacity current making a question of any feasible system of regulation almost an impossibility with a smaller amount of power to be delivered.

By the use of reactance coils at the sub-station the generator current at no load can be made very small, and I believe it will pay to put in reactance coils on long lines, not only to reduce the generator current and line loss at no load, but as sub-station voltage regulators. If half the charging current be neutralized, the lower limit given for the power that may be transmitted over a 100-mile line will be reduced one-half.

I believe the proper way to regulate the voltage at the sub-station is by the use of adjustable reactance coils and a compensated voltmeter at the generating station. In any case, feeder regulators should be put on the feeder circuits, but no regulators on transformers, especially where two or more banks are operated in parallel.

Finally we come to the regulation within the sub-station. A sub-station must deliver voltages that are constant within short periods, at the very least. The customer may demand a voltage variation on account of the losses within the distribution lines as his load changes, but during such periods as the customer's load remains constant, the voltage must remain constant. The fact that his voltage may change with his load demands some system of manual regulation within the sub-station, and while a possibility of varying the voltage at the sub-station on the customer's lines as much as 15 per cent is in almost the extreme case ample allowance, the fact that the generator will necessarily alter its voltage with an alteration in the character of the load, irrespective of its size, it is not generally safe to install a sub-station system in which at least 25 per cent voltage variation is not, in the extreme cases, possible.

In this paper nothing very startling has been presented, but it is the writer's opinion that the following points are somewhat new and demand careful consideration:

1. The subdivision of water wheels and the use of extremely high-speed machinery.

2. A wide range in the possible voltage variation in the generators, with generators and transformers both designed not for good non-inductive load regulation, but for good inductive load regulation.

3. Lines designed for the smallest possible capacity current without reference to any attempt at balancing the line capacity against the load lag.

4. The use of reactance coils at the sub-station—instead of regulator heads on transformers—and wide range of regulators in feeder circuits.

### A New Method for Starting Three-Phase Induction Motors.

An ingenious system for starting three-phase induction motors, the invention of Herr J. Fischer-Hinnen, is employed by the Krizik establishment in Prague, and is described in a French contemporary, from which the following description is translated:

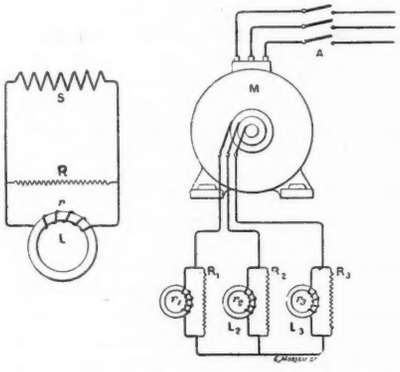
In general, starting arrangements comprise variable resistances inserted in the circuit of the rotor, of which the resistance is progressively diminished as the motor takes its speed. The success of the starting operation and the amount of current wasted in it are dependent in no small measure upon the operator who manœuvres the rheostat. While this is a decided inconvenience, there is another even more serious in the cumbersomeness and expense of the rheostats necessary, especially when these are combined with means for changing the direction of rotation of a motor. When the position of the motor and the controlling rheostat are variable with regard to one another, as is the case when such motors are used on traveling cranes, the number of contacts necessary is considerable and they are a fruitful cause of trouble and annoyance.

The system described below is claimed to have avoided these difficulties in a highly ingenious manner. It is well known that at the moment of starting the motor behaves like a transformer with a closed secondary circuit, the currents generated in the rotor being of precisely the same frequency as those circulating in the stator. As the motor increases in speed the frequency of the induced currents in the rotor diminishes, and when full speed of operation is attained this frequency is represented by a trifling fraction of that of the primary circuit.

Referring to Fig. 1, suppose there is included in each of the secondary circuits $S$ of a motor a large non-inductive resistance $R$ shunted by a resistance $r$, which is very small compared with the other, but possesses a high coefficient of self-induction $L$. At the moment of starting the coil of high self-induction acts in all respects like a very high resistance, and the two coils act together in much the same way as would two large resistances in parallel. If these inductances and resistances have been properly calculated the motor will start up under load, taking only a small current. As the speed increases and the frequency in the secondary circuit diminishes, the apparent resistance of the inductive coil diminishes and the large ohmic resistance is thus shunted by an apparent resistance of constantly decreasing magnitude. Finally, when full speed is attained, the total apparent resistance of the starting system is sensibly equal to the ohmic resistance of the self-induction coil, which is of course very small. The starting arrangement as described remains always in circuit, having only a slight influence on the normal running of the motor, which appears as a small diminution of the power factor and a slight increase in the amount of slip.

Consider two parallel conductors having respectively resistances $R_1$ and $R_2$, and coefficients of self-induction $L_1$ and $L_2$. For the two the total apparent resistance is $R=\frac{a}{a^2+b^2}$ and the inductance for a current of frequency $\omega$ is

$$\omega L=\frac{b}{a^2+b^2},$$




FIGS. 1 AND 2.—NEW METHOD OF STARTING INDUCTION MOTORS.

where

$$a=\frac{R_1}{R_1^2+\omega^2L_1^2}+\frac{R_2}{R_2^2+\omega^2L_2^2},$$

$$b=\frac{L_1}{R_1^2+\omega^2L_1^2}+\frac{L_2}{R_2^2+\omega^2L_2^2}.$$

This gives:

$$R=\frac{R_1(R_2^2+\omega^2L_2^2)}{(R_1+R_2)^2}+\frac{R_2(R_1^2+\omega^2L_1^2)}{\omega^2(L_1+L_2)^2},$$

$$\omega L=\frac{L_1(R_2^2+\omega^2L_2^2)}{(R_1+R_2)^2}+\frac{L_2(R_1^2+\omega^2L_1^2)}{\omega^2(L_1+L_2)^2}.$$

In the case under consideration $L_1=0$ and the maximum of $R$ is given by the condition $R_1=\omega L_2$. Let $R=\omega L$.

The total resistance of the two conductors in parallel is then, at the moment of starting, equal to $\frac{R}{2}$. At this instant, therefore, only half of the current passes through the resistance coil which allows a dimunition of the section of the wire of which it is made.

It is thus seen that starting is accomplished automatically. The necessary apparatus is reduced to a three-point switch on the leads to the stator. It is not possible to have "bucking" at the start, as may happen in hand-manipulated systems when the resistance is cut out too rapidly, and it is not possible, either, to burn out rheostats by attempting to work them too quickly; at the same time the motor gets up to its running speed in the minimum of time.

Fig. 2 shows the application of the arrangement to a three-phase motor. The motor is furnished with the usual three collector rings and the starting switch is shown at $A$. The coils and resistances are shown in star connection, though it is easy to see how they would be arranged if the triangle connection is preferred. It is claimed that the apparatus can be made so small that it can be placed inside the rotor, thus doing away with the collector rings.

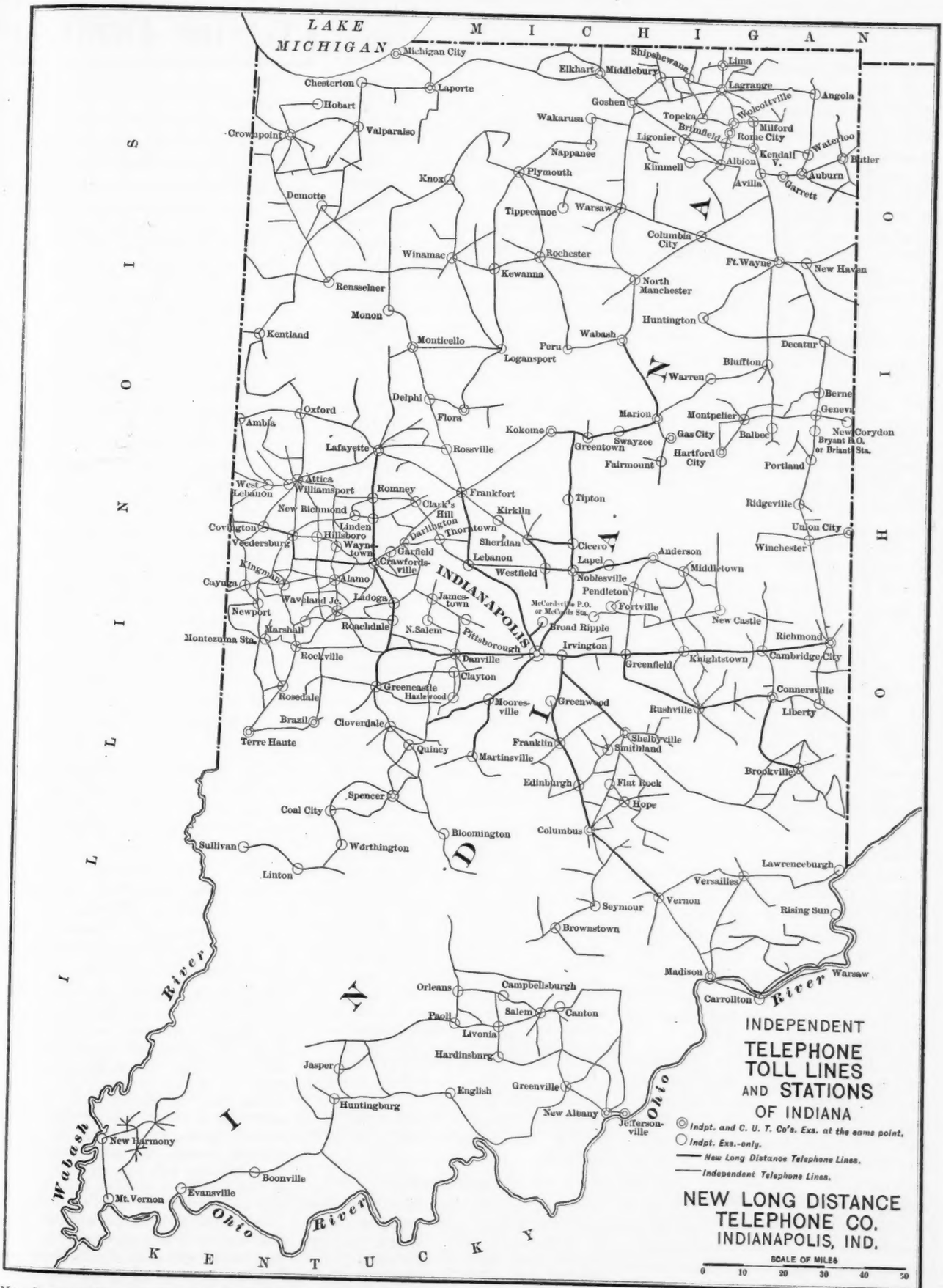
### Independent Long-Distance Telephone Lines in Indiana.

The interesting map shown on the opposite page represents the independent long-distance lines in the State of Indiana, those shown as heavy lines being owned and operated by the New Long-Distance Telephone Company, of Indianapolis. These lines are of copper metallic circuits and only a glance at the map is necessary to show the large extent of country that they cover and their importance as means of communication in the inter-state business of Indiana.

Six years ago there was not a telephone in the house of an actual working farmer in the state; now there are nearly 8,000 of them installed and in operation. During the period covered by the independent movement—six years— 160 independent exchanges have grown up in Indiana with an aggregate of 25,000 stations connected.

Only three years ago the independent telephone lines in the state aggregated but 300 miles in length; now there are nearly 7,000 miles of these lines—more than half of the independent exchanges in the state being connected with Indianapolis by full copper metallic circuits. It is curious to note that only one year ago none of the independent exchanges was thus connected with the capital city. In no part of the United States is independent telephony in a more flourishing condition than in the great middle West, where such states as Ohio, Indiana and Illinois are covered with net-works of toll lines and dotted with numerous exchanges.

On the Indiana system the maximum charge for conversation from Indianapolis is $1.00 for five minutes' conversation. All of the rates are based on this period and overtime is charged for by the minute at one-fifth of the toll rate for five minutes. It has been discovered by the managers of the lines that patrons prefer not to have the expiration of the five minute period announced to them so no announcement is made, the parties taking as long as may be desired and then paying on the minute basis with a five-minute minimum. Night rates are about forty per cent less than day rates.




MAP SHOWING INDEPENDENT TELEPHONE EXCHANGES AND INDEPENDENT TELEPHONE TOLL LINES IN THE STATE OF INDIANA.—(See page 154.)

### The Electric Kitchen at the Paris Exposition.

In the Spanish pavilion, on the Quai d'Orsay, in the grounds of the exposition at Paris, it was desired to install a restaurant, but permission was given for it only under the express condition that there should be no burning of coal or gas or oil, in order to avoid smoke and all possible danger of fire. Under these circumstances the concessionaire naturally turned to electricity and a highly elaborate electric kitchen has been installed, the apparatus being manufactured by a French firm. Between 300 and 400 guests are cared for daily and an elaborate menu is served. Since the restaurant was opened, on April 24, more than 22,000 persons have been served in it. The maximum current used is 350 amperes at 110 volts. About 70 kilowatt-hours per day are used in keeping hot coffee, chocolate, tea and other hot drinks. About 280 kilowatt hours are used in cooking, properly speaking, representing an output of about 450 watt-hours for each service of food to a guest. The price paid for electrical energy is nine and one-half cents per kilowatt-hour, the mean consumption per guest, therefore, amounting to about six cents. The prices charged for food are about the average of such charges at the exposition. The electrically-heated apparatus used are of the Parvilleé type, in which a metallic powder is mixed with various proportions of a non-conducting enamel, thus making blocks of high-resistance material well adapted to develop heat under the application of electric current. It is claimed that this type of solid resistance can be carried up to incandescence in the open air without damage. Plates two inches by four inches and one-eighth inch thick can be produced having a total resistance of 100 ohms, or about 1,000,000 times greater than that of the metal used in its construction. The material, it is also claimed, can absorb 16.5 watts per kilogramme.

The restaurant kitchen is furnished with a great oven, four by seven feet, provided with eight heaters, which can be carried up to a temperature of 1,200 degrees centigrade. Four of the plates absorb 25 amperes each, and four others 20 amperes each. The heat not used for cooking is utilized to keep plates hot, etc., at odd times. There is installed also a roasting oven, which is capable of broiling meats with heat from red-hot plates. This apparatus absorbing 35 amperes. A similar but smaller apparatus uses 25 amperes. There are also two other ovens, one heating from the base and the other from the top, absorbing up to 20 and 50 amperes, respectively. In the latter of these roasters, 75 pounds of meat can be roasted in about three hours, with a mean intensity of current of 40 amperes. In addition to these apparatus there is installed a water boiler having a capacity of 30 quarts and consuming 20 amperes, and a soup kettle of the same capacity and consumption. Smaller apparatus such as coffee pots, tea pots, etc., are heated on small hot-plates and there is also installed a water bath, or water steam-cooker, utilizing 20 amperes of current. The whole is one of the most complete electric cooking outfits that has ever been installed.

### Electric Traction in Berlin.

In a contribution to a German railway journal on the question of electric traction for the Berlin local and suburban railways, Mr. Schubert advocates the greatest possible distribution of traffic. With ordinary locomotives he thinks this impossible, but with electric traction he considers that 180 trains could be despatched per hour in each direction, as against the 12 per hour at present running. The service is apparently much of the same kind as that which we mentioned in a recent issue as being given on the Swansea & Mumbles Railway, where trains with several carriages run at infrequent intervals, and are then almost empty, says the London *Electrical Engineer*. In the case of Berlin, Mr. Schubert thinks that in place of the nearly empty trains of 8 or 10 carriages, with accommodation for 1,450 passengers, which run during the periods of minimum traffic, a single car affording accommodation for 75 passengers might be despatched. Electric traction would further render the present railway capable of dealing with a daily average of 253,000 passengers, the present capacity in passengers carried being only 143,000 per diem. As to conversion, also, this might be easily accomplished. For the whole of the local and suburban lines, 300 cars would be necessary, while the total cost of the equipment of the lines for electric traction would be about £150,000. He questions, however, whether it would not be advisable under the existing condition of things, to entirely separate the local traffic from that of the suburban circular railway, and for the present introduce electric traction onto the inner lines only.

### A Correction.

In the article describing the Cape Nome-St. Michael cable, in the last number of the ELECTRICAL REVIEW, an error of the types made the diameter of the finished core three-thirty-seconds of an inch. It is, in reality, eight-thirty-seconds or one-quarter inch in diameter, under the tape.

## ELECTRIC LIGHTING

The electric light station at Glens Falls, N. Y., was burned on the morning of August 12, leaving the town in darkness.

At a recent meeting of the directors of the Lowell, Mass., Electric Light Company, it was voted to increase the capital stock of the corporation from $300,000 to $400,000 and to offer $100,000 of new stock to the stockholders of record May 23, 1900, at par, subscriptions to be paid September 1.

The Street Commissioners of Hagerstown, Md., have signed a contract for building the municipal electric light plant, the George A. Williams Company, of New Jersey, being the contractors. Their bid was $52,590.20. Mr. Williams is already at work and will push the construction of the plant. The Westinghouse Company is at work on the electrical equipment. Mr. Williams will give out the contract for the power house to local contractors in a few days.

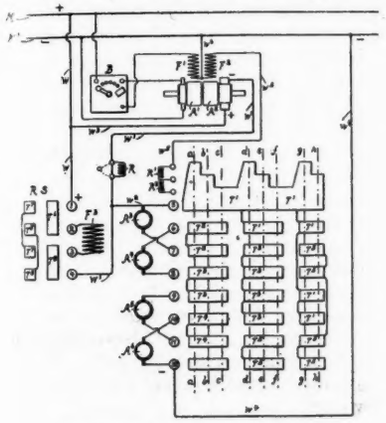
The Manchester Electric Company, of Manchester, N. H., one of the properties managed by Tucker, Anthony & Company, has just purchased the Merrimac Electric Light, Heat and Power Company, all of Manchester, N. H. Tucker, Anthony & Company will combine all of these interests with their present properties, which consist of the Manchester Electric Light Company, the Manchester Street Railway Company, the Ben Franklin Electric Company and the Garvins Falls Power Company. The parent company now controls all the lighting, power and street railway interests of that section, including water-power of 10,000 to 15,000 minimum horse-power, and 15,000 to 20,000 maximum.

### Automobile Exhibition and Race Meet in Chicago.

As announced before, the International Automobile Exhibition and Race Meeting will take place at the Washington Park Club grounds, in Chicago, September 18 to 22 inclusive. About 75,000 square feet of exhibition space is available and the plans for the exhibition are progressing most favorably. All of the large manufacturers of automobiles in the United States have signed contracts for space and it is expected that several foreign manufacturers, among them French and English houses, will also exhibit. The race features will be highly interesting, as over $10,000 in trophies and cash prizes will be distributed. The exhibition and races are under the auspices of the Chicago *Inter-Ocean*, and details regarding it may be obtained from Mr. D. W. Bowles, the business manager of that journal. It is expected that this will be one of the most important automobile events that has ever taken place in the United States.

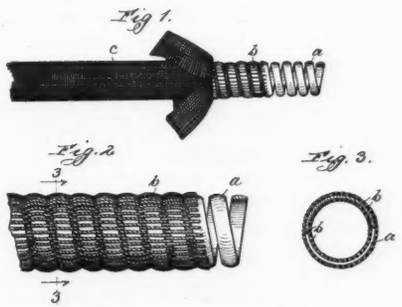
## RECENT ELECTRICAL PATENTS

A patent for a new system of governing and regulation for electric motors of the series parallel type has been granted to Robert Lundell, of New York. The invention has for its objects a method for controlling series of parallel motors by varying the field strength and by coupling the armature circuits in series parallel combinations, and means whereby all external resistance in series with the armature circuits may be dispensed with, particularly at the time when the motor connections are shifted from series to parallel. At the same time there is combined with this a method for automatically returning current to the line when the motors are running at low speed, thus making them act as brakes. It is claimed that the method employed permits a great variety of fixed speeds to be used and eliminates sparking at the controller contacts and at the brushes. In the illustration is shown a small motor generator, the capacity of which is approximately 75 per cent of the maximum watt losses in the field windings of all the motors which are to be coupled. The series windings of the motors are connected permanently in series with one another. The motor generator is used in connection with the main current to vary the field strength of t motors in a definite and predetermined way, a small resistance being used for varying the current supply on the generator side of the motor generator.



ELECTRIC MOTOR REGULATOR.

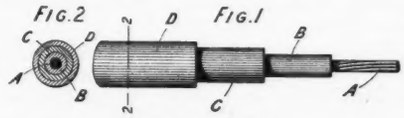
A novel flexible electrical conduit has been patented by Harry G. Osburn, of Chicago, Ill., the object being to provide a device of this character which, while possessing the necessary rigidity and insulating property, may be readily flexed or bent laterally to accommodate itself to the conditions of use, and at the same time be manufactured at a comparatively small cost. In the preferred form of the invention the conduit is formed from an element of semi-flexible material which is bent or coiled into helical form to produce a tube-like structure, the convolutions or turns being bound together or locked in a longitudinal direction by means of elements of pliable or flexible material interwoven or interconnected with the successive turns or convolutions to impart longitudinal strength to the tube—that is, strength to withstand distortion under a tension or pull lengthwise of the tube. The material should be sufficiently flexible to permit of being bent into tube-like form, while having sufficient permanency of form to preserve the tube-like shape without undue tendency to collapse or flatten, as would be the case if the material were too pliable, and therefore, the patent contemplates any material capable of being bent into the proper form and having sufficient rigidity of structure to preserve its form under the conditions of use. In the preferred form of construction, the semi-flexible material is made




FLEXIBLE ELECTRIC CONDUIT.

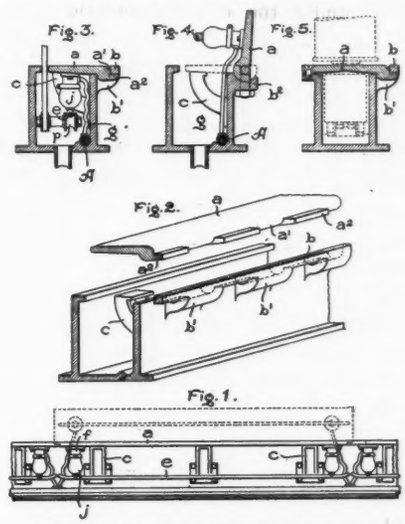
of strips of cane or bamboo, and the flexible material used to bind or lock the convolutions together is thread or yarn, which may be readily interwoven with the cane. A suitable braided covering is employed to complete the conduit.

A new insulation for submarine cables has recently been patented in this country by John Y. Buchanan, an Englishman residing at Edinburgh, Scotland. The novel feature resides in using ozokerite in the insulation. In applying the invention, the conductor is first coated with a layer of gutta-percha, which is in turn enclosed in a compound form of india-rubber and ozokerites and the whole is then surrounded by an outer coating of gutta-percha. More layers of the compound may be used if desired, and the entire cable may be protected by suitable sheathing or armor.




ELECTRIC CABLE.

One of the latest improvements in conduit electric railway systems consists in providing a conduit with a hinged cover made up of a plurality of independent sections. Each section of the cover carries an independent section of the conductor which is arranged to be in connection with a main-supply conductor when the cover is closed, but which is disconnected when the cover is open. It will thus be seen that an exceedingly simple constructon is provided which allows ready access to the conduit for the purpose of cleaning and repairs and which, when opened, protects the circuit from being grounded and the workman from shocks. The system is the invention of Frank M. Ashley, of New York city, and is controlled by the General Electric Company.




CONDUIT ELECTRIC RAILWAY SYSTEM.

### Electrical Inspection in Chicago.

City Engineer Ellicott, of Chicago, has received the semi-annual report of electrical inspection made to him by Chief Inspector H. H. Hornsby. The number of inspections made during the last six months breaks all records of the department, 9,054 having been made in that time. In addition to this large number there are 475 examinations now in progress by the department. There were 2,791 defective pieces of electrical work found by the men, which probably saved thousands of dollars in the prevention of fires from those causes. A written report to Chief Inspector Hornsby was made in each case. The receipts of the six months amounted to $13,352.31, while the expenditures were $9,009.12.

The ELECTRICAL REVIEW protests because manufacturers persist in making automobiles that look like a horse vehicle without a horse. It does seem as if originality in designing self-propelling carriages would pay.—*Boston Globe.*

## THE AUTOMOBILE WAGON FOR HEAVY DUTY.*

BY ARTHUR HERSCHMANN.

It can be easily proven that the progress of civilization made by all nations has been closely interwoven with the progress of transportation. In olden days, men were well satisfied to live, grow, and end their days wherever destiny planted them. There they established themselves, contented with the pursuits of life which were within easy reach, looking to Nature for their maintenance, and buying and trading with their immediate neighbors, and within narrow bounds. It would be outside the scope of this paper to discuss whether life was then less comfortable than it is to-day, and whether the few commodities then obtainable were insufficient to make existence enjoyable.

At the present day our needs are considerable, varied and ever increasing. It is no exaggeration to state that many a person's happiness is marred for a good many hours if an express package containing personal goods coming from a great distance should not arrive on the hour.

We all know how an improvement in the facilities for rapid passenger transit shifts the centres of districts where people congregate to manufacture, and the districts where they gather to live. Towns prosper or decay according to transportation facilities, and the value of real estate is seriously affected by them.

The manufacturer and the farmer know what it means to buy and sell where the opportunity is greatest, and how important the item of quick, safe and economical transportation of their goods has become at the present day, when the fluctuations in the value of raw material have become an ever increasing factor in the cost of the finished product.

Before the advent of the railroad overland transportation was limited to the public highways. Washington maintained that the future prosperity of the country would depend on more horses and national roads, and it can be said that his prediction has been fulfilled if we only substitute for the word "horse" the words "motive power." When, long after Washington's days, the locomotive appeared, the prevailing idea was that there would be little further use for horses and that all traffic would soon be handled by steam roads. It was different. The fact became apparent that traffic begets traffic, and that the increased opportunity which the railroad presented stimulated local enterprise and necessitated the employment of more horses and wagons to ply to and from railroad stations. It can be safely stated that the amount of merchandise hauled by horses on our streets and over short distances is as great in the aggregate as that carried by the railroads over long distances.

The advent of the bicycle and of the trolley car characterized similar periods of apprehension on similar lines, and yet statistics show that the number of horses in use has so far been little affected.* However, it bids fair that with the advent of the motor carriage this increase may now be checked, to give way gradually to a diminution in the number of horses used. Some enthusiasts have already predicted that it will be only a few years before there will be no horses on the streets. The sanguinism is not justified. However, while the horse will continue to remain man's best friend among the brute creation as a saddle horse, and will probably never be wholly substituted in the propulsion of fancy carriages, there can be but little doubt that the motor freight vehicle has come to stay and will eventually supersede the horse as a beast of burden. It will evidently be a question of some time and evolution before it will become a universal institution and of the greatest importance to transportation interests.

The motor wagon presents a problem which should admit of no prejudice. It is a case free from sentiment, and merely influenced by economic considerations. The elements constituting in principle a successful motor vehicle were known and experimented with by enterprising engineers some 80 years ago. The reasons why those experiments did not lead to results are not far to seek. It was then the time of railroad development, and the new competition from the railroad did not encourage costly experiments in a competitive line. Furthermore, the machinery used in the motor carriages was in a crude and undeveloped state. The revival of the movement, which may be said to have begun not more than 10 years ago, has met with a great deal of indifference and prejudice. It has been contended that these wagons would frighten the horses, while we can say to-day that most horses soon become accustomed to the peculiarities of their new competitor. Most of this opposition has come from prejudiced quarters; many of the opinions have been volunteered by persons who have never ridden in a motor carriage, and whose remarks were intended for consumption by the home circle. The advantages of any kind of self-propelled vehicles are patent to any one who stops to give the matter unbiassed thought. One has only to think how quickly a motor wagon, with its reduced length, can thread its way through crowded thoroughfares, and how it thus saves road space which is at present occupied and made dangerous by the oftentimes erratic horse.

The smell caused by the worst of the present-day vehicles is not so bad as the smell emanating from horses with which we have to put up in hot weather.

It may be contended that the heavier weights supported by the largest types of motor wagons will damage the roads, but this can be proven to be a fallacy, since even if such damage did occur it would be more than outbalanced by the pounding and tearing action of the horses' hoofs.

One of the necessities for the successful running of motor vehicles, for some time to come, will be a good road surface, and those responsible for the maintenance of public roads could well afford to encourage the new movement, seeing that by the use of motor wagons a considerable saving will be effected in the matter of street cleaning, let alone the improvements in the hygienic condition of the roads.

The matter of safety has often been doubted, and, while we will consider it later when studying the characteristics of different systems of motor wagons, it may here be said that statistics have already shown the new vehicle to be far safer from accidents than the horse-drawn vehicle.

At times the horse will stop of its own sweet will, and refuse to budge, but in case of emergency, using his best efforts he could seldom pull up from full speed inside of less than 30 yards. It necessarily takes time to communicate the driver's will to the horse's brain, and from there to the horse's muscles. A motor wagon, on the other hand, can be quickly stopped, as powerful brakes are within easy reach of the driver, whose intelligence alone is challenged in case of emergency. In addition, the driver of the motor wagon will have a clear view of the road ahead without being perched high in the air. It is very difficult to avoid an accident with a horse-driven wagon should the pole chain break, and it is naturally most likely to break when it is most wanted, *i.e.*, when suddenly pulling up.

There is another item which is strongly in favor of the motor wagon as compared with the use of horses. Horses are dependent on the weather. Flies molest them in Summer time, and the driver is often led to believe they are sick or tired, and will naturally slacken up for fear of straining them. Climbing a steep hill he will often get off the wagon to save his horses, and it is evident that all this interferes with economical transportation.

We have briefly touched the matter of brakes, and this really is the nucleus of the speed question. We need only consider the speed of modern railway trains and ask ourselves whether such a speed could be safely maintained without the use of air-brakes to approach the speed question of motor wagons. It is an easy matter to provide for powerful brakes on a motor wagon, and the propelling motor lends itself in many cases as a very powerful second brake. We have found that a load of three tons on a motor wagon, running at a speed of eight miles, could be pulled up in eight yards, a performance which could never be obtained with horses. It may have escaped the notice of the onlooker that when we speak of an eight-mile gait

* Extracts from a paper presented at the Cincinnati meeting of the American Society of Mechanical Engineers.

*Horses in United States on January 1, 1893 about 16,000,000; on January 1, 1899, decreased to about 14,000,000.

with horses it should be asked, how long can they keep it up, and then it should be considered that it would probably only approximate a five-mile gait of a motor wagon, which latter never gets tired, runs evenly, and is ready to do work as long as we provide fuel, and, further, is satisfied to remain where we leave it when put out of commission. The latter consideration is an economic advantage not to be overlooked in the operation of motor wagons.

Taking up the different propelling agencies which have been experimented with so far, we find that almost every known motive power has been tried. Steam was employed as early as 1820, and such wagons were built by the world-renowned Ericsson and Tangyes in England, and even James Watt is said to have constructed a steam carriage. With the low steam pressures then available, poor roads, and difficulties with unreliable material and workmanship, it is not surprising that the matter was allowed to drop. The next experiments were in the line of oil engines, followed by electric vehicles, compressed air, carbonic acid and the revived steam carriage.

Naturally, in this country, leading the world in electrical subjects, expectations were greatest with electric vehicles. The electric equipment renders a vehicle clean and easy to operate. These vehicles can be made to answer the requirements of running on smooth city roads. The suitable commutation of battery cells provided in these vehicles, effected through inter-connection of contacts on the "controller," affords, together with the series and multiple arrangement of the motor, some flexibility in the power and speed conditions of the machine. There are, however, inherent disadvantages to the use of batteries, which grow prohibitive in a motor wagon intended to carry heavy weights over a long distance.

Next to the electric wagon we saw the auto-truck, or, better still, heard about it. It was stated that compressed air trucks would soon be operated in considerable numbers. Now, while it can not be denied that compressed air would make an ideal motive power, we have still to look for a complete revolution in the construction of light storage tanks to render this power available for trucks, granting that other disadvantages inherent to the use of compressed air can be practically overcome. Weight for weight, stored electricity lends itself more readily to the propulsion of wagons, since it will, as it were, "keep pressure" until it becomes well nigh exhausted, while the air pressure falls gradually as the air is drawn from the storage tanks. The tank weight per cubic foot of air is about 85 pounds; the air itself weighs 11 pounds, and at 2,000 pounds per square inch, represents 0.27 horse-power hours. To heat the air, considerable weight has to be carried.

Carbonic acid has also been proposed for the operation of wagons, but it suffers in common with compressed air, and, moreover, the raw material to be compressed is by no means cheap.

It has been proposed to compress illuminating gas, and use it for the propulsion of gas motor-wagons. While the radius of the operating district for such a vehicle would be evidently greater than with the other storage systems, seeing that about 18 cubic feet of gas at normal pressure would already give one brake horse-power, whilst about as many cubic feet of air of 200 pounds pressure, or of carbonic acid of a high pressure are required. This system has, however, the disadvantage of seriously complicating the mechanism.

A great deal of experience has been gained with oil-motor wagons, though chiefly in the line of light pleasure vehicles; and France, in which country there are many thousands of these vehicles plying, has led the world in their exploitation.

As regards freight vehicles, however, no important results have been obtained with the use of explosive motors. A motor wagon, on account of its great weight and peculiarity of operation, must have an abundant supply of power; so great, in fact, as to puzzle the uninitiated observer. We find that a load which can be easily negotiated by one horse, calls for a power equipment equal to about 14 horse-power on the part of a motor wagon. While we commonly understand that one horse-power equals 33,000 foot pounds per minute, we should consider how great the work of a horse can be for a short time while on the race track, or when he becomes infuriated, and with "blind staggers" dashes into destruction. A horse, when required to pull a heavy load out of a difficult position, will not only jerk and lift the shaft so as to bring the wheels out of a rut and get them on a level, but will momentarily exert power which has been, by means of a dynamometer, shown to be adequate to a performance of what we commonly call 14 horse-power. Some people, in fact, assert that the horse can, for an instant, by far exceed the latter figure, but we may be well contented to accept this as a basis of calculation for the supply of motive power. The same horse having pulled his wagon out of the difficult position, is able to modify the output of his energy, propelling the wagon at a good rate of speed as soon as he reaches better ground. The "speed-changing device," which should as nearly as possible emulate the peculiarity of the horse's muscular system, is still the greatest problem with designers of oil wagons. The most ingenious devices have been already tried with a view of filling this gap, and with more or less success; they consist chiefly of such elements as spur and bevel gears, belts, chains, shifting wheels, expanding pulleys or combinations of some of the above devices, with brakes and clutches. Even hydraulic and electric combinations have been unsuccessfully tried. An oil engine to run a motor wagon can not well be designed to vary in speed, at least not in a wide range, and be satisfactory in other respects. Its construction necessitates its running at a constant speed, whilst the speed requirements of the wagon wheels, to which it is geared up, are ever changing. Clutch and shifting gear wheels are, therefore, essential parts of every oil-motor wagon, and their operation, on account of the impact of the moving masses, often gives rise to serious trouble. Non-reversible, an oil engine is by no means a flexible motor. It will not start under load, and when it is in running condition, it is very dependent on an even influx of its explosive mixture, and is liable to come to a dead stop without warning when its capacity has been suddenly overtaxed. Anybody who may have gotten stuck with a motor vehicle while ascending an incline will appreciate these remarks. In such a case it will occur to him that it is very difficult at the same time to release the brake and start the wagon "ahead" on slow speed. It need hardly be said that an oil vehicle is dependent on the weather, inasmuch as the action of the carburetter is influenced by the atmosphere. This latter idea leads to the subject of perfect or imperfect combustion and its attendant outward sign, which is an evil-smelling exhaust. The good behavior of large oil engines on heavy trucks after an extended period of running has not yet been satisfactorily proven, and the deterioration due to the pounding on the frame is a serious drawback. The general use and handling of large quantities of gasoline at this stage of evolution of the oil engine is by no means free from risk of explosion, and there is some danger of affecting perishable goods and foodstuffs by the odor, which would naturally permeate them, particularly while standing at the express company's depot.*

Having thus described the difficulties with which the electric and oil wagons have to contend, we may devote ourselves to the steam wagon, with which, undoubtedly, important results have already been obtained. Before entering into the technical details of the steam wagon, it would be well to consider the problem from an economic and managerial point of view, since it seems that with the best constructed motor wagon, propelled by any power, the technical aspects are still subservient to the commercial. We have found the steam wagon superior to its competitors for the following reasons:

1. It has the greatest load and mileage capacity, or, in other words, radius of action.

2. Its operation is independent of charging stations, and supplies, necessary for the operation of the wagon, can be easily procured and taken aboard quickly.

The operating expenses in the case of an electric (or, in fact, of any power storage system) vehicle, grow to be prohibitive as soon as a certain ton mileage capacity is exceeded, tending to keep such an electric wagon small in size.

In the case of an oil wagon such economic restrictions to the size do not exist, and the objections to an oil wagon of large capacity are more by virtue of difficulties in operation.

*If it were possible to make a practical success of an oil motor wagon, using crude oil, no doubt the scope of the oil-motor wagon for heavy duty would be considerably increased.

*(To be concluded.)*

## AUTOMOBILES

A St. Louis press despatch says it is proposed by the projectors of the Kinloch Park race course to build an elevated railway track around the circuit near the inner rail for the purpose of running a patrol judge's motor vehicle to keep pace with the flying steeds. It is expected that trestle work and track will cost about $5,000, and the carriage for the patrol judge about $1,000. Under this plan the judge could keep his eye on the jockeys and horses all the way round. At present he is stationed at the head of the stretch, and can see what the boys are doing only when they round the turn into the home run. After that he makes no pretense of observing them, as the clouds of dust usually obscure his vision. If the present plans carry, truer racing would likely result. The track will be open September 1, and is hoped to have the arrangement completed before the coming season closes.

An important automobile exposition will be the exposition at the Greater Inter-State Fair, at Trenton, N. J., to be held September 24, 25, 26, 27, 28. The Board of Governors of the Greater Inter-State Fair has wisely decided to afford all manufacturers of the United States an opportunity to show their vehicles, without any great expense to them. They have erected a special building for the automobile interests and no charge is made for exhibition spaces. Nearly every manufacturer will be represented by several vehicles of his make, also all the accessories will be exhibited. To judge at present from the applications filed with the secretary, Mr. M. R. Margerum, more than 30,000 square feet will be needed. The managers of the Trenton Fair have offered a special trophy to the Automobile Club of America to organize a club run from New York to Trenton on September 22, two days previous to the opening of the Trenton Inter-State Fair, this trophy to be known as the New York-Trenton Cup. Another cup has been offered to the Automobile Club of Philadelphia to organize a club run on the same day from Philadelphia to Trenton. Only American vehicles are to participate in these runs. These offers have been accepted by the two clubs. The members of affiliated automobile clubs can participate, either in the run from New York to Trenton, or from Philadelphia to Trenton. All contesting vehicles will be on exhibition on September 24, the opening day of the fair. Besides the five races organized for that day, there will be contests of automobile stopping and automobile driving between obstacles. A one-half mile driving track, 66 feet wide, with curves raised two feet, seven and one-half inches will afford an excellent opportunity to show all the good points of the competing vehicles in the races as well as in the other contests.

Recently, interest in Chicago has been increased in the automobile by the *Inter-Ocean,* one of the large morning newspapers, which has championed the cause of the automobile by promoting an International Exhibition and Meet, to open September 18 and continue until September 22, inclusive, at the Washington Park Club grounds, in Chicago. The elaborate programme that has been prepared is attracting the attention of both manufacturers and private owners of automobiles and motor cycles throughout the world. Ten thousand dollars in prizes and trophies will be awarded in the various contests, which will consist of distance races, novelty races, fancy and trick driving by expert operators, tests of utility with vehicles of the numerous kinds of motor power in use, hill climbing and rough road tests and other interesting and exciting features of the programme. One of the most unique parts of the entertainment will be the exchanging of passengers by vehicles running at a high rate of speed. Washington Park Club grounds are especially adapted for an exhibition and meet on such a large scale as this one has been planned. Their location, centred as they are within easy access of all the surface and elevated transportation lines of the city, and with a convenient switch for having all railway shipments landed directly to the grounds, affords superior facilities for accommodating exhibitors, as well as the throngs of visitors which such a meet will call together. On the grounds there is in course of preparation every possible mechanical device for successfully carrying out the programme. Elevated platforms, inclines, rough roads, boulevards and traffic roads will be ready to test the full power and operation of the horseless vehicle. The fact that the *Inter-Ocean* has undertaken to act as sponsor for the meet, leaving special rights and privileges for any particular exhibitor or manufacturer entirely out of the question, has had an effect of confidence among all exhibitors, and inspired them with enthusiasm in their preparations. As a result of the keen interest which has been awakened by this coming exhibition and meet, the Automobile Club, of Chicago, has been formed and a permanent organization effected. This club is composed of leading business and professional men of the city who have seen the possibilities of the automobile, and, in addition to the pleasure features of the organization, have for its purpose the betterment of streets and roads in city and country. This club is aiding the *Inter-Ocean* in every possible way to make the exhibition a benefit to the motor vehicle manufacturer, the exhibitor, the public, and a credit to Chicago. Much encouragement has come from European cities where automobiles have gained recognition.

### Wall Street and the Electrical Stock Market.

The stock market during the current week was uneventful, except for the fact that a part of the new British war loan was successfully floated here. According to reports heard to-day, over one-half of the total loan of $50,000,000 was allotted to American subscribers. The fact that Great Britain finds it necessary to turn to the United States as a borrower of money possesses significance. During the week, and wholly owing to subscriptions to the British war loan, there were heavy exports of gold to Europe. The unusually hot wave during the week was largely responsible for the stagnation in the stock market. The week closed with a market influenced by cheerful views of the early ending of the Chinese crisis. These views were acquired from London and were reflected in Wall street.

On the New York Stock Exchange, General Electric closed the week at 132 bid and 133½ asked, a gain of 2½ points for the week. Metropolitan Street Railway, of New York, closed at 153½ bid and 155 asked, a loss of 1¼ points for the week. Third Avenue Railroad closed at 109 bid and 111 asked, indicating no change for the week. Brooklyn Rapid Transit closed at 57⅝ bid and 57⅞ asked, a gain of ¼ point for the week. Manhattan Railway, of New York, closed at 90¼ bid and 90¾ asked, a loss of ½ point for the week.

On the Boston exchange, American Telephone was not quoted. Erie Telephone closed at 96 bid and 98 asked, a gain of 1 point for the week. New England Telephone closed at 120½ bid and 124½ asked, a gain of ½ point for the week.

On the Philadelphia exchange, Electric Storage Battery was not quoted. Union Traction closed at 36⅛ bid and 37 asked, a loss of ½ point for the week. Electric Company of America closed at 8⅞ bid and 9 asked, indicating no change for the week.

On the curb, or outside market, in New York, Electric Vehicle closed at 20 bid and 22 asked, a gain of 1 point in the bid price for the week. Electric Boat closed at 15 bid and 18 asked, a loss of 1 point in the bid price for the week.

Wall street, August 11,

## VIEWS, NEWS AND INTERVIEWS

A contemporary states that a broken telegraph circuit near Newport, Me., occasioned by the destruction of two poles by fire, was quickly reestablished lately by the utilization of a long, iron rail of a bridge, beside which the break occurred.

Thomas N. Fordyce, of Detroit, who has a 30-year contract with the state of Ohio for the operation of boats on the Miami canal with electricity as the motive power, is quoted as saying that the section of the canal between Cincinnati and Dayton will be electrically equipped within two months.

The submarine torpedo boat Holland made its first dive at Newport, R. I., recently, under a naval crew, and everything worked satisfactorily. The test was made at Coddington Cove and the boat was kept under water for half an hour. During that time it was run for half a mile on a straight course, and then there was some practice at diving and turning. There was a crew of 11 on board, seamen gunners from the torpedo station, the boat being in charge of Lieutenant Colwell, lately naval attaché at the Court of St. James.

There is a merry war in Jersey City, N. J., the weapons used being pianos, organs, trombones, French horns, cornets and other dreadful implements of torture. It appears that a certain once quiet street has become the scene of fierce turmoil of loud-jangling pianos, tooting trumpets and screeching sopranos—and all because a peaceful electrical man moved into a neat cottage in the street and sought restful silence after hard days in the clangor of the machine shop. He liked music—once. He would not have minded one piano, or even a violin, but 17 pianos in one block of buildings opposite his cottage drove him to expostulation. The reply was the purchase of an automatic piano-playing machine by one of the 17 piano owners. This was too much. The electrical man rushed out and bought a cornet (he can not play a cornet) and proceeded to learn the scales on that pleasing instrument. His first toot was the signal for a storm of piano-playing. And the war still goes on. Every night the bold electrician goes to his front window and opens his rapid-firing toot machine. Then a heavy battery of organs opens on his left, a machine piano in front of him, while a pom-pom trombone gets into action near the corner of the block. The last bulletins report the besieged garrison of one holding out well, with plenty of ammunition for the cornet left.

One awfully blizzardly night in January, I was seated in the little dog house called a telegraph office, on the Chicago, Burlington & Quincy Railroad in Illinois, says a writer in the Chattanooga *News*. The time was midnight, and I was deeply engrossed in that thrilling detective story, "Shadowed by Three," when the door flew open and a specimen of humanity entered my office.

Several things were the matter with him.

He was nearly frozen, excited to the point of insanity, and could not talk English.

The purpose of his visit was made known by grunts, signs and a jargon of unintelligible language—he wanted to send a telegram, and I was to copy it from his dictation and then send it on the wire.

The nativity of my caller was Swedish. He repeated to me, I am sure six hundred times what he wanted to say in the message, and as he could only talk Swede, I tried to make a message out of it, with English spelling. When, after almost coming to blows about the thing, I finally accomplished the task to the best of my ability, and my attempts resulted in a message reading as follows:

"Ole Oleson, Monmouth, Ill.—Hess Hesson hedeatlaiku acoom heair savare ahashutehasel.
(Signed) Yon Yonson."

This message I read over to the caller just as it sounded to me, and he nodded that it was all right; consequently I sent it to Monmouth, and the next thing I heard of it was three days later, when a dozen Swedes visited me to either find out why Ole Oleson had not come to our city, or to do me bodily injury. The matter was left to arbitration, and when Ole was heard from, he explained that he did not understand the message. When it got to him it was adorned with all the fantasies of which such words in the hands of young operators are capable. His copy read:

"H E. 6. H. E. 6. Pdumukuacoom hays sa 44 are ahasshun Pazli."

After various diplomatic essays, it developed that my customer had been talking to me in "English" with a Swedish dialect, and that what he wanted to say was:

"Hess Hesson, he dead, he'd like you come here answer, he shoot himself."

The Indianapolis, Ind., Street Railway Company has decided to erect a new power house and has purchased ground for that purpose. As soon as the new structure is ready the company will abandon its old power house and will derive all of the power for propelling its cars from the new plant.

### "Why Should an Automobile Look Like a Horse Vehicle Without a Horse?"

TO THE EDITOR OF ELECTRICAL REVIEW:

To give a correct answer to this question I should be obliged to say I don't know. Why do most people like oysters? I don't know. What is electricity? I don't know. But these are facts in human nature and we have a right to discuss them.

Away back in the long ago history of the world some honest farmer came to the conclusion that there was an easier and better way of taking his produce to market than by dragging it on poles fastened to the backs of his cattle. So he went to the woods and taking a good-sized oak tree he cut a log about six feet long and three feet in diameter. He hacked out the centre in such a way that he had two large wheels on each end of a strong wooden shaft. Upon this shaft he fastened a large box, to one end of which he attached the shaft to which he hitched his cattle. Thus we have in short the beginning of the carriage, the wagon, and the automobile.

To be sure there was a great improvement when the wagon was made to rest on four wheels which turned upon axles. It may be interesting to note here that although the wheels of the wagon are made to turn upon an axle, and that we have improved upon the ancients in this respect, yet we have only to look at the running gear of any box car and we find that the wheels are still fastened to the axles and that there is no improvement over the ancient idea.

But let us consider what a wonderful thing is the wagon. Think for a moment what it has done for the farmer. Every vehicle that rests on wheels is only a modification and thus we can include all the conveyances of our cities.

The business world has seen but few great epoch-making changes and it may be a strong statement to say that when our ancient farmer made his first pair of wheels a new division in the business world had its dawn. But his was the true invention and all the other vehicles are but improvements, even to the most modern automobile.

Thus we see that our wagon has quite a history, the automobile being the last step. But why should the automobile and the wagon have a common history? For an answer to this question we must ask the man who first made a horseless wagon. He would undoubtedly say that he took the wagon as a pattern because it was the best running, the easiest to ride in, and the most handy to build. At any rate an automobile is nothing more or less than a horseless wagon; the precedent is formed and it is imperative.

READER.

Aultman, Ohio, August 8, 1900.

# ELECTRIC RAILWAYS

A trolley line 53 miles long will be built from Norfolk, Va., to the Dismal Swamp.

Plans now under consideration contemplate a new electric road connecting Exeter, N. H., with Salisbury Beach.

A contract which provides for the completion of the power station of the Houghton County, Mass., Street Railway by November 17, was recently signed. By its terms the plant shall be ready for operation by September 17.

The Cherry Hill, Elkton & Chesapeake City, Md., Electric Railroad Company is now formally organized with a capital stock of $150,000, and everything seems to be shaping up promisingly for an early commencement of work on its construction.

The Massachusetts Railroad Commissioners have authorized the Northampton & Amherst Street Railway Company to issue 60,000 five per cent 20-year additional bonds for funding its floating debt and to meet the cost of abolition of grade crossings.

It is understood the men who are back of the proposed electric air line between Taunton and New Bedford, Mass., fully intend to begin operations early in the coming Spring. According to plans the running time between the two cities will be about an hour and a quarter.

The International Construction Company, of Detroit, has been awarded the contract for building the Flint, Saginaw & Bay City Electric Railway. It will be 50 miles long and will use the third rail system. The contract is with the Saginaw Suburban Railway; price, $800,000.

It is announced that the Citizens' Light and Power Company will complete the electric railway between Newport News, Va., and Hampton, which was started by the defunct Peninsula Railway Company. This, with the one to be built by the Hampton Roads Company, will make three lines between the two cities.

The New York State Railroad Commission has authorized the Central Park North and East River Railroad Company, of New York city, and the Metropolitan Street Railway Company, by which it is leased, to use the underground electric trolley system of motive power on Dey street, between Greenwich and West streets.

The Camden & Suburban Railway Company, of Camden, are making efforts to secure the right-of-way through Riverton, N. J., which will permit their constructing a trolley line through the township, with a well-equipped power station either in or near Riverton. The township committee of Riverton have the matter under consideration.

The Boston & Maine Railroad is operating the street railway system at Portsmouth, N. H. The roadbed is laid similar in manner to a steam road and the cars are operated at a speed as high as 20 miles per hour. The road is laid with 60-pound rails. The main feed wire is of aluminum. The company will also operate cars for freight and express matter.

The construction of the Concord branch of the Lexington & Boston, Mass., Street Railway is progressing rapidly, and the line will be opened in August. It will be four and one-half miles long, and leaves the Billerica & Lowell route of the company at Wilson Park, in Bedford, extending thence along the Concord Road, past West Bedford station and through the Old Road to Bedford and Bedford street, in Concord. Sleepy Hollow is passed and the line makes its terminus in Monument Square, by the Wright tavern.

An electric railroad from Grand Rapids, Mich., to Grand Haven and Muskegon is to be built at once. The company has just completed organization at Grand Rapids, with James D. Hawks, head of the Detroit, Ypsilanti & Ann Arbor Road, as president, and Wallace Franklin as treasurer. All funds are secured for the line, which will cost $1,500,000, and is to be one of the model electric roads of the country. The track will parallel the highways and most of the right-of-way is now secured, with provision for a double track. All grading will be done before Winter, and a power house built, probably at Spring Lake.

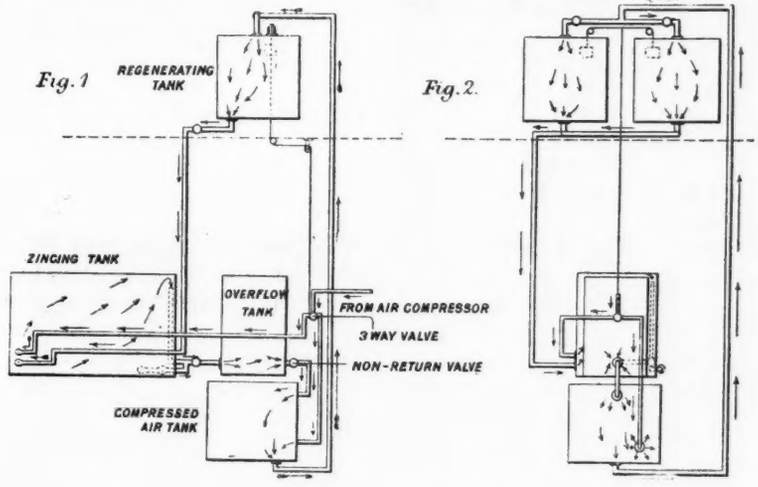
It is reported that there is a movement on foot to connect Oolitic, Bedford, Mitcheel, Orieans, Paoli, the West Baden and French Lick Springs, in Indiana, by an electric line railroad. This project has been talked of before but it is now positively known that capital and parties who are interested in such deals are lending an interested ear to this project, and it is expected that ere long the scheme will be made public. A line of this kind would catch all the traffic from every railroad connection to these famous resorts, which have patronage from every state in the union. Oolitic is situated three miles northwest of Bedford, Ind., in the celebrated Oolitic stone region, and is a growing and thriving town.

Preliminary surveys are being made for an electric railroad from Syracuse, N. Y., to Auburn. L. W. Serrell, of New York, is in charge of the work. Several Syracusans are behind the proposed road. They have been promised financial aid by New York capitalists. The plan is to construct an electric road from Syracuse through the towns of Camillus and Elbridge to Auburn. A branch road is to be built to Skaneateles village. "This will not be a difficult road to build," said one of the promoters recently. "There will be no grade crossings and the state railroad commission will not have anything to say about it. The project is being seriously considered. It will be an advantage in every way to connect two cities of 120,000 and 26,000 population."

Stockholders of the Syracuse, N. Y., & Oneida Lake Electric Railway Company are to vote, on August 21, on a proposition to increase the capital stock of the corporation from $300,000 to $1,200,000, consisting of 12,000 shares of $100 each. The company has bought materials for the construction of the road, and work may be under way next week. Part of the road, it is said, will be in operation before next Winter, and cars will be running to South Bay next Summer. The company buys its own materials and is to let contracts for the actual work in three parts—one from the centre of the city to Spring and Centre streets, another from the latter point to South Bay, and the other from Spring and Centre streets to Phœnix. Twenty double-truck cars have been contracted for.

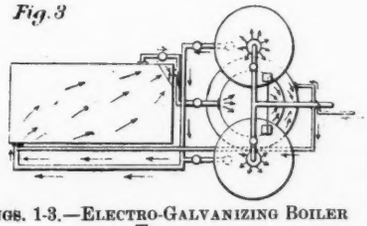
It is announced by the promoters of the Buffalo, Niagara Falls & Rochester Electric Railway that the necessary rights-of-way have been secured and that the company will apply for permission from the state railroad commission to begin the construction of the road. Articles of incorporation have been prepared; in these it is stated that the capital stock of the company is $3,500,000, consisting of 35,000 shares at $100 each. The directors are Allen C. Beach, of Watertown; William H. Gillette, of Charlotte; Charles S. Baker, George L. Brown, George Moss, Milton Clark, George A. Brooks, Henry D. Quinby, William C. Gray, of Rochester. The length of the road between Rochester and Buffalo is to be 86.44 miles, and that of the road between Niagara Falls and Buffalo, 33.56 miles, making a total length of 120 miles. The directors make affidavit that at least $1,000 of the capital stock for each mile of road has been paid in.

The building of an electric road between Berlin, Waupaca, New London, Wautoma and Weyauwega, Wis., is now practically assured, and the actual work of construction will probably commence before September 1. The first preliminary survey of the route has been completed, and it is thought that the engineers will finish their location work by August 15, so that a large portion of the grading can be done this Fall. The main line of the electric railroad will run from Berlin to Waupaca, and thence to New London, with a stub running from a point where










FIGS. 1-3.—ELECTRO-GALVANIZING BOILER TUBES.

the line will touch Lake Poygan to Wautoma. Much new territory will be opened up in order to catch the freight business from the farmers. An innovation in Western railways will be introduced which is known by the name of the Bonner rail wagon system. This new system provides for a new style of trucks upon which a wagon can be driven from the ground without any elevation. After the load has been deposited on the truck it is jacked up with jack-screws and is ready to be transported for any distance on the rails, as has been demonstrated on roads now in operation in Indiana and Ohio. The freight business will be carried on along the same line as the passenger traffic, but will be an independent branch of the business inasmuch as a separate schedule of cars and time tables will be in use for passenger cars which will be operated after the manner of steam roads.

### Electro-Galvanizing Boiler Tubes.

Electro-galvanizing is now being extensively used for the protection of boiler tubes, both in England and abroad, the admiralty specifying that all boiler tubes should be coated externally with a coating of zinc equal to one and one-quarter ounces per square foot, and that economizer tubes should be coated inside and outside with an equal thickness.

The illustration we give is that of a Cowper-Coles regenerative plant that has recently been erected for the Germania Shipbuilding and Engineering Company, at Tegel, near Berlin, for the coating of boiler tubes, such as are used in the Thornycroft and Yarrow water tube boilers.

The dynamo is capable of giving 3,000 amperes at six volts, and is direct coupled to a three-phase motor, which is provided with a pulley for driving a small air compressor, which is used for circulating the electrolyte. The electric current is conveyed to the depositing tank by means of bare copper strips. The switchboard is provided with ammeter, voltmeter and main switch; a resistance is found to be unnecessary. The circulation of the electrolyte is effected in the following manner (Figs. 1, 2 and 3): The acid solution falls over a wooden sill placed in one corner of the zincing tank, into an overflow tank, and then flows into a compressed air tank. When air is blown in, the solution is forced up into the regenerating tanks; a non-return valve is placed in the pipe connecting the overflow tank to the compressed air tank, to prevent the air escaping into the zincing tank. The supply of air to the compressed air tank is regulated by means of a three-way cock actuated by a float placed in the regenerating tank in such a manner that when the air is cut off from the compressed air tank, it is blown through the solution in the zincing tank, thus keeping it agitated. Zinc dust is placed in the regenerating tanks, or wooden grids covered with cocoanut matting, mixed with finely divided coke or sand, so as to form a filter lead, and at the same time regenerate the electrolyte. The regenerated electrolyte returns to the zincing tank at the bottom of the opposite corner to which it leaves the regenerating tanks.

The electrolyte contains 35 ounces of crystallized zinc sulphate to the gallon of water. In practice it is found very important to keep the zincing solution slightly acid, otherwise the zinc coating will not be adhesive, and will have a tendency to blister. The best proportion of free sulphuric acid is about one-tenth to every gallon of water. The amount of free acid in solution is quickly determined by using capsules of gelatine containing known quantities of alkali. A small portion of lacmoid solution is then added, and if a pink color is obtained, it indicates the presence of more than 10 ounces per gallon of free acid; if a violet color is obtained, the solution contains less than 10 ounces of free acid per gallon.—*Engineering.*

### Surface Mail Cars in New York City.

The Metropolitan Street Railway Company has served notice upon Postmaster Van Cott, of New York city, that it wishes to terminate the Third Avenue line street car mail-carrying agreement on September 1. The present arrangement, which was made three years ago, was continued by the Metropolitan Company after it had absorbed the Third Avenue system. The agreement will expire on September 1, and President Vreeland came to the conclusion that a renewal of the existing arrangements would be unsatisfactory. He notified Postmaster Van Cott that the company did not wish to hamper the government in any way, and that, if it was impossible for the government to make other arrangements, the company would continue to do the carrying for some time longer.

The interurban electric road between Rockford, Ill., and Janesville, is being pushed forward with vigor. A private right-of-way 33 feet in width, paralleling the highway, is being secured. This work is nearly completed and will give the company an independent position and largely increase its facilities. The work of construction will begin as soon as the right-of-way is secured. The principal office will be in Rockford. The new line will be called the Rockford, Beloit & Janesville Electric Railroad.

# TELEPHONE AND TELEGRAPH

An increase in the capital stock of the New York Telephone Company from $16,000,000 to $30,000,000 was authorized by the stockholders of that company at a special meeting on August 8.

The New Long-Distance Telephone Company, of Indianapolis, Ind., has issued a well-arranged and comprehensive directory of telephone exchanges and toll stations in Indiana which are reached by direct copper metallic circuits.

A fifth submarine cable between England and Germany is projected, and £100,000 is included in the German Budget for the purpose. Since the last cable was laid in 1896, the annual number of telegrams has increased from 1,867,868 to 2,465,613.

Robert W. Spring, general manager of the Pittsburgh & Allegheny, Pa., Telephone Company has awarded the contract for the erection of the new Allegheny exchange of the company to Contractor Charles Reif, of Allegheny, for $16,500. The building will be completed in 60 days. It will be one of the most ornamental structures of its kind in Allegheny. The Pittsburgh & Allegheny Company will begin at once the installation of telephones in Pittsburgh, and the work will be rushed along by General Manager Spring as fast as the large force of men can handle them.

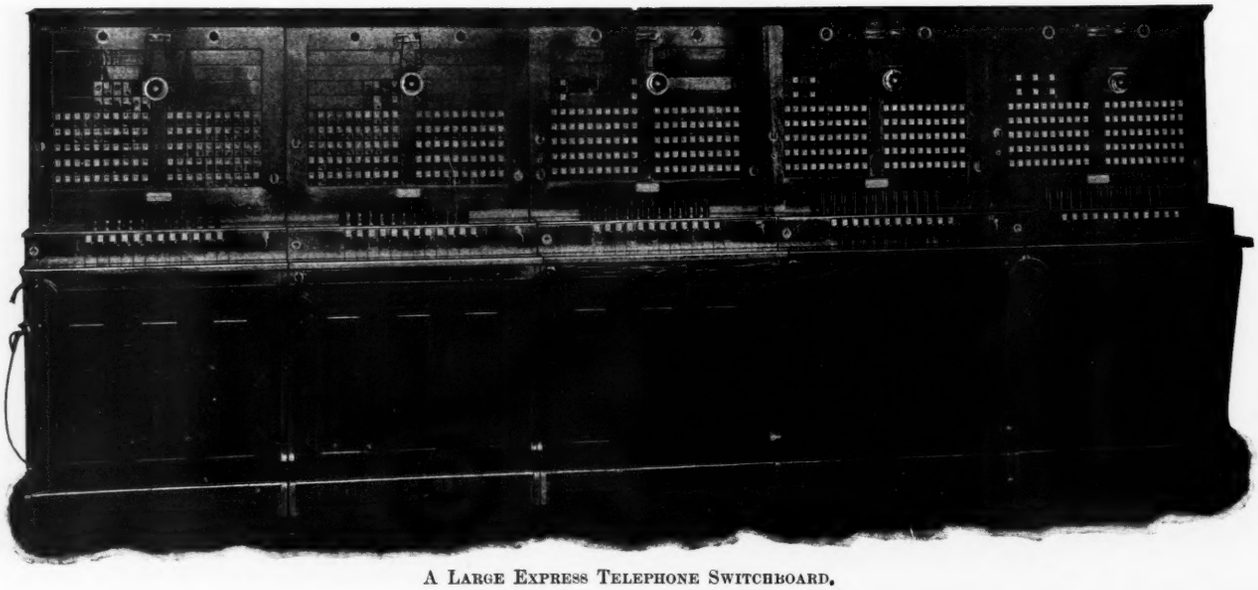
A charter has been issued by the Secretary of State of West Virginia for the Romney & Cumberland Telephone Company, of Romney, W. Va., with an authorized capital of $5,000. It is proposed to operate a system between Romney and Cumberland, *via* Springfield, Frankfort and Patterson's Creek Depot, also from Frankfort to Cumberland, *via* Daniel's Mills and Point Station, also from Slanesville to Springfield. The incorporators are: I. H. C. Pancake, William S. Guthrie and G. P. Nutter, of Romney; R. M. Washington, W. P. Washington and C. M. Miller, of Springfield.

Articles of incorporation have been filed by the American District Telegraph Company to conduct its business in the states of Washington, Idaho, Oregon and Montana. The company is incorporated for $100,000, and it is divided into 1,000 shares. A. D. Campbell and Thomas P. McKinney were named as trustees to serve for six months. The incorporators are: A. D. Campbell, Thomas P. McKinney, Isaac McMichael, Jacob Levinn and Sidney B. McMichael. Isaac McMichael is superintendent of the Western Union Telegraph Company in Minneapolis and Jacob Levinn is assistant superintendent. Sidney B. McMichael is superintendent of the American District Telegraph Company, which now covers Minnesota, the Dakotas and Wisconsin.

This is a Philadelphia despatch appearing in a Boston financial paper: "It is said that the permanent officers of the National Telephone and Telegraph Company will be announced about the middle of August. The statement is denied here that the officials of the Massachusetts Telephone Company, of Boston, Knickerbocker Telephone Company, of New York, and the Boston & New York Telephone Company will have any connection whatever with the new company, nor will the properties controlled by the independent telephone companies comprise any part of the National company's assets. The scope of the National is far greater than can be imagined and it is believed here that the assets of the company will finally consist exclusively of properties working under contracts with the American Bell Telephone Company and the telegraph and cable properties now owned by the Western Union Telegraph Company, Commercial Cable Company, German Cable Company, Postal Telegraph Company, Hayti Cable Company, the Inter-Ocean Telegraph and Cable Company, and the Mexican and South American Cable Company. The company will be largely interested in the new Pacific cable system and will extend its ownership of cables to other companies."

### A Large Express Telephone Switchboard.

The illustration shown herewith represents a switchboard for 1,000 circuits with 500 lines installed and equipped with pilot "supervisory" visual signals. It is claimed by the maker, the Eureka Electric Co., Chicago, that boards operated on its press system with visual signals and upon the supervisory method have achieved great success, as they are capable of being operated at high speed. The same concern is making large boards on central energy systems, either kind using local batteries at the station or centralized battery, and pilot lamp visual signals operating in the transfer as well as in the line drop.



A LARGE EXPRESS TELEPHONE SWITCHBOARD.

### Telephone Material Wanted.

Mr. J. C. Haner, of London, Ohio, informs the ELECTRICAL REVIEW that he will be glad to receive catalogues and lowest prices for poles, wire, cables, tools, telephones and switchboards for constructing a telephone exchange for 600 subscribers.

### Insulators for High-Tension Transmission Lines.

With the great and rapid development of high-tension transmission of electricity for light and power purposes, the question of insulation for line construction has been full of difficulty for electrical engineers. Some years ago, Mr. Fred M. Locke, who was at that time a telegraph operator on the New York Central & Hudson River Railroad, at Victor, N. Y., made some studies and experiments in the construction of insulators prompted by his observation of the workings of telegraph lines. His early efforts developed further theories for the construction of porcelain and glass insulators capable of withstanding the highest tensions. The method of manufacturing and testing these insulators, as employed at the Locke factory, together with the principle of their construction, is of considerable interest.

FIG. 1.—STANDARD TYPE OF LOCKE HIGH-TENSION INSULATOR.

The type of insulator which is now being manufactured in this factory for the highest voltages is known as the Victor type of Locke insulators. This insulator is made in 20 styles, the general construction of which is with an eave-trough around the periphery of the insulator for carrying off rain water, though not all are made with this eave. Fig. 1 shows the standard type, of which 70,000 are now being manufactured for immediate application on various power transmission lines. Fig. 2 is of interest as showing a pile of 20,000 of these large insulators. This insulator is glazed around with a long glass centre, and is 10½ inches in diameter, 11 inches high, weighs 12 pounds, and is capable of withstanding a pressure of 60,000 volts; each insulator, however, is given a salt water test of 120,000 volts. The leakage at 60,000 volts is said to be less than one watt, and at 50,000 volts the leakage is about one-eighth of one watt. Fig. 3 shows six of the 20 types of this insulator. The principle of construction of each will be easily understood by noting the contour, and that some are with glass bases and others with porcelain.

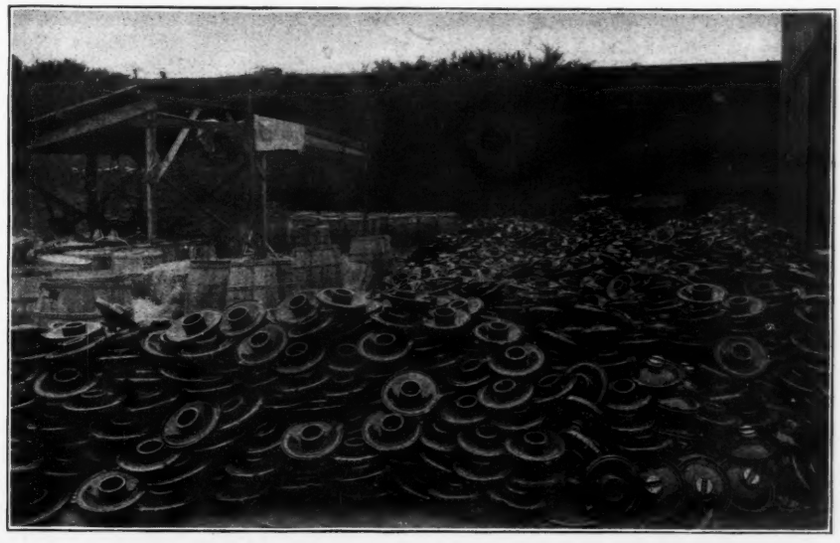


FIG. 2.—A PILE OF 20,000 INSULATORS WEIGHING 12 POUNDS EACH.

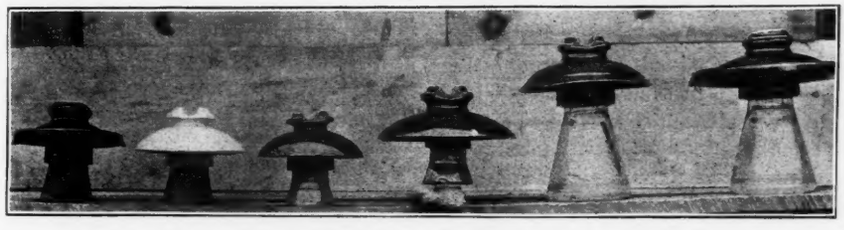


FIG. 3.—SIX TYPES OF LOCKE HIGH-TENSION INSULATORS.

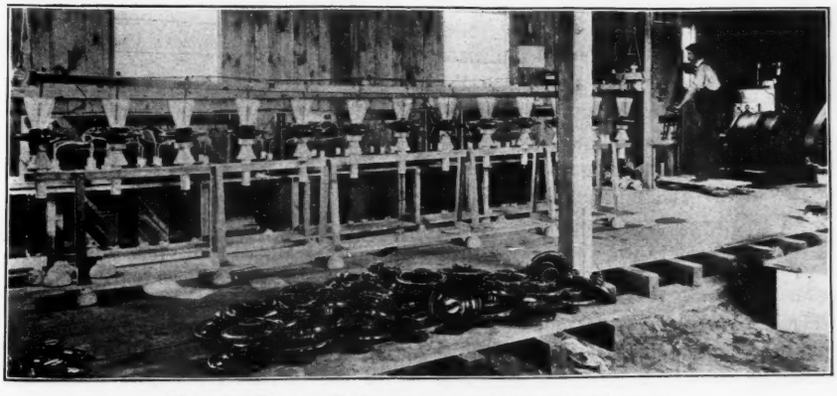


FIG. 4.—TESTING DEPARTMENT FOR LOCKE INSULATORS.

An interesting step in the production of these insulators is the method of testing. A Stanley generator of 8,000 and 16,000 alternations carries current to a low-tension transformer at 500 volts, and from this transformer the current is led into a high-tension transformer at 50 volts; it is here raised to 10,000 volts in each transformer. The equipment consists of three banks of transformers of four each and they are connected in series so as to develop 120,000 volts. One terminal is led to the metal cups which are filled with salt brine, and in which the head of the insulator is immersed. The other terminal is connected with steel rods which are placed in the glass or porcelain centre. When the high-tension current is applied if there should be a defective insulator in the group it will immediately puncture a hole through the outer glazing, indicating the defect by a flash and sharp snap. This testing system is shown in Fig. 4. All the insulators produced in this factory are tested to double the line capacity for which they are intended.

### Electrical Progress in Madison, Wis.

[*From the Madison Democrat.*]

Electrician "Dick" Howe is giving the fire-alarm boxes a fresh coat of paint.

# CORPORATION NEWS

ANSONIA, CT.—The Connecticut Insulating Wire Company, of Ansonia, has increased its capital from $5,000 to $7,000, of which increase $1,000 has been paid in.

BATH, N. Y.—The Bath Electric and Gaslight Company, of Bath, has been incorporated. Capital, $100,000; directors: N. W. Dalton, M. A. Dalton and J. F. Parkhurst, Bath.

NEW YORK CITY—The Ideal Electric Contracting Company, of New York city, has been chartered to deal in electric appliances. Capital, $1,000; incorporators: H. Nekritz, W. E. McKeen, A. Hirshfeld, all of New York city; B. Ginsburg, attorney, New York city.

THOMPSON, PA.—The Northeastern Pennsylvania Telephone Company, of the borough of Thompson, Susquehanna County, was chartered at the state department, at Harrisburg, recently, with a capital of $10,000, to construct telephone lines in the counties of Susquehanna, Wayne and Lackawanna.

PHILANTHROPY, OHIO — The Butler County Western Telephone Company, of Philanthropy, has been chartered to conduct a telephone system. Capital, $5,000; incorporators: J. Moorhead, C. Conn, W. S. Beard, S. E. Fue, J. F. Gillespie, W. A. Beard, R. D. Gillespie.

NORWOOD, MASS.—The directors of the Norwood, Canton & Sharon Street Railway Company have filed a notice with the commissioner of corporations announcing that half of the capital stock of the road, $67,500, has been paid in cash. William Otis Faxon is president and J. F. Perry is treasurer.

NEW YORK CITY—The Herkimer Construction and Improvement Company, of New York city, has been incorporated to construct and equip railroads and telegraph and public works. Capital $10,000; directors: Robert Earl, second, Herkimer; Louis W. Stolesbury and Thomas E. O'Shea, New York city

ST. LOUIS, MO.—At a meeting of the stockholders of the Laclede Power Company it was voted to increase the capital stock of the company to $800,000. The company has heretofore secured its power from the Laclede Gas Company, but it has decided to erect its own power plant, and the additional money was needed for this purpose.

DAYTON, OHIO—The Dayton, New Carlisle & St. Paris Traction Company, of Dayton, has been incorporated with a capital stock of $1,350,000. The incorporators are: B. H. Rannells, H. S. Forgy, Charles E. Layton, Harrie N. Reynolds and John A. Broke. The company proposes to construct and operate an electric road from Dayton to New Carlisle and from Dayton to St. Paris, passing through the counties of Montgomery, Miami, Clark and Champaign.

TRENTON, N. J.—It cost the Electric Storage Company $3,600 to file amended articles of incorporation with the Secretary of State. Ordinarily, no charge is made. The original certificate gave the company a corporate existence for 50 years. The amended certificate gives it a perpetual existence. The Secretary of State insisted that by reason of the amendment the state would lose the fee it would otherwise receive at the end of 50 years, hence a second charge was made. The company paid the money under protest, and the matter is likely to get into court. Had the provision for a perpetual existence been included in the original certificate a second fee would not have been exacted.

## The Fourth Avenue Tunnel.

[*From the New York Times.*]

This paper has repeatedly denounced the "conservatism" which has been content, years and years after the last excuse had disappeared, to leave the railway tunnel between the Grand Central Station and the Harlem River a place of torture for the thousands of unfortunates daily forced to pass through it. Our denunciations seem to have had no effect upon the corporation responsible for the outrageous conditions of New York's Black Hole. Perhaps the ELECTRICAL REVIEW, which has now taken up the matter with great vigor, will be more fortunate in bringing about the long-delayed and much-needed reform. We certainly hope so, and will not feel a bit of jealousy if it attains the success which we have missed. The writer of the article declares that there are absolutely no engineering difficulties in the way of substituting electricity for steam as the means of drawing cars through the tunnel, and that the installation of the requisite plant would not cost more than $800,000, while the expense of operating it would be about the same as that incurred under the present system. He confidently prophesies moreover, that the population of the beautiful and convenient suburbs served by the two roads using the tunnel would so increase on the abolition of the existing horrors that the investment would be immediately, highly and permanently profitable. That surely is an argument calculated to move even railway "conservatism."

[*From the New York World.*]

The ELECTRICAL REVIEW describes with scientific accuracy the dreadful conditions prevailing in the railroad tunnel and switching-yards north of the Grand Central Station, and indicated a single and economical remedy for them.

It is pointed out that the section of the tunnel south of Forty-second street is "the most agreeable portion of a journey on an open car over this line. It is clean, well lighted and naturally always cool. All of this has been accomplished for it by the introduction of electric traction."

With this object lesson before them, the ELECTRICAL REVIEW well says that "the railroad managements handling the heavy traffic in and out of the Grand Central Station have hardly a legitimate excuse for retaining the annoying steam locomotives in their tunnels."

The same thing is of course true of the switching and make-up engines that now render life a burden and good sleep an impossibility to 50,000 people in their neighborhood. The REVIEW says that, "from the engineering point of view, the problem of constructing, operating and maintaining the necessary conducting system and locomotives is absolutely easy," while "the expenses of operating the electrical section would not differ greatly from those now met in working the section by steam locomotives."

If the city has not the power to require these reforms, will not an enlightened self-interest impel the railroad and tunnel companies to adopt them.

[*From the Hartford (Conn.) Times*]

It's now the ELECTRICAL REVIEW which takes up the cudgels against the condition of the tunnel running from the Grand Central Station to the Harlem River. In any agitation that looks toward the reform of this hole the patrons of the tunnel will cordially join. The demand for improvement is great and growing.

Those who assume to know insist that no engineering difficulties in the way of the substitution of electricity for steam as the motive power of trains in the tunnel exist. The proposed reform appeals powerfully and directly to the thousands of people who daily pass through this gateway of New York. The two great transportation systems that use and control the tunnel have an opportunity to undertake a great improvement.

## BOOK REVIEW.

**Hints on the Packing and Preservation of Merchandise in the Tropics. An eight-page pamphlet, published by the Indian Textile Journal Company, Bombay, India. Supplied by the ELECTRICAL REVIEW at 30 cents.**

This timely and valuable pamphlet was written by a man on the ground, familiar with the market for export goods, and treats of a number of varieties of merchandise and the necessary precautions to be taken for its proper preservation. Metal and wood goods, chemicals, oils, etc., textile fabrics and many other classes of goods are spoken of, with plain directions for their packing and preservation.

### Sub-Stations for the Manhattan Railway Company.

The Manhattan Railway Company, of New York city, has filed with the department of buildings plans for three sub-stations from which power will be distributed to the East Side divisions. The sub-stations are to be five stories in height, and each will cost $28,000. One station will be in Division street, near the corner of Allen; another at the southwest corner of Third avenue and Ninety-fourth street, and the third in Thirty-fourth street, just west of Second avenue. Work on the stations will begin just as soon as the contracts can be let. The buildings will be of iron and brick fireproof construction. The first floor of each of the sub-stations will be occupied by the rotary converters. The transformers will be on the second floor. On the third will be the storage batteries, which will insure against stoppage should there be an accident at the central station. The storage batteries could keep the roads in operation for two or three hours. Plans for sub-stations of a similar character to distribute power to the West Side roads are now being drawn.

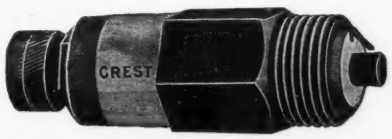
FIG. 1.—CROSS CONNECTING AND FUSE DISTRIBUTING BOARD.

### Lighting Cities in Haiti.

United States Minister Powell, of Port au Prince, informs the Department of State that the Haitian Government has concluded to furnish light to its cities, and in future not to grant concessions for this work to others. The Government will cancel all concessions and pay the holders for their plant and for such amounts as have been expended by them. The Government also promises to introduce a system of electric lights for the capitol early in the Fall. American electrical manufacturers should have another opportunity here.

### A Sparking Plug for Gas Engines.

One of the largest difficulties that has been encountered in the electrical ignition of gas engines has been trouble with the sparking plug, especially when what are called "jump" sparks are used. This variety of spark is produced from the high-tension secondary of an induction coil, and leaps the intervals between points in the cylinder of the gas engine, making a bright, hot spark that ignites the mixture of gases. Of course, it is evident




A SPARKING PLUG FOR GAS ENGINES.

that the insulation of the plug through which the terminals of the induction coil are led into the ignition chamber or cylinder of the gas motor must be very nearly perfect, and that the material of which it is made must be able to withstand successfully the enormous heat generated by the explosion of compressed mixtures of gas and air.

The variety of sparking plug here illustrated was one that was designed to ob-

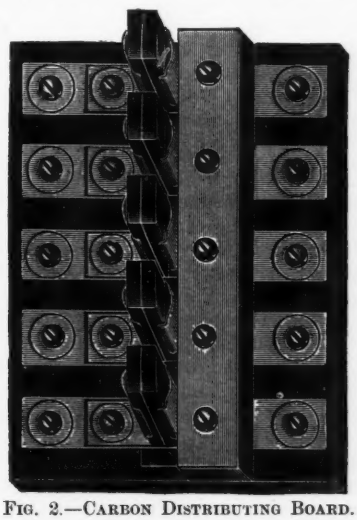


FIG. 2.—CARBON DISTRIBUTING BOARD.

viate many of the troubles that have marked the use of porcelain and such materials in the construction of plugs. It is made of a material that is claimed to withstand the heat and pressure of the explosion chamber without detriment, and which, being soft and not brittle like porcelain or glass, is not liable to crack in service. The plug proper consists of a steel shell threaded to fit the chamber of the motor and containing a cone of the material mentioned, which, it is claimed by the makers, the Crest Manufacturing Company, Cambridgeport, Mass., makes a gas-tight joint and is, therefore, not subject to the danger of being spoiled by careless or unskilled persons. A wire passes through the insulating material and terminates at the bottom of the plug in an enlarged head. A platinum wire is inserted in the top of the steel shell and between these two the spark jumps across.

### Telephone Exchange Accessories.

The distributing board, where the wires of various circuits entering a telephone exchange are distributed to the jacks on the switchboard, is apt to be the most complicated place in the exchange, and is often a source of considerable trouble because of the great tangle of wires involved in it. The illustrations here shown represent three types of accessory apparatus made by the Central Telephone and Electric Company, of St. Louis, Mo., for the solution of the distributing board problem.

Fig. 1 shows a simple cross-connecting and fuse-distributing board, the operation of which may be understood at a glance. This can be made up, of course, in sec-

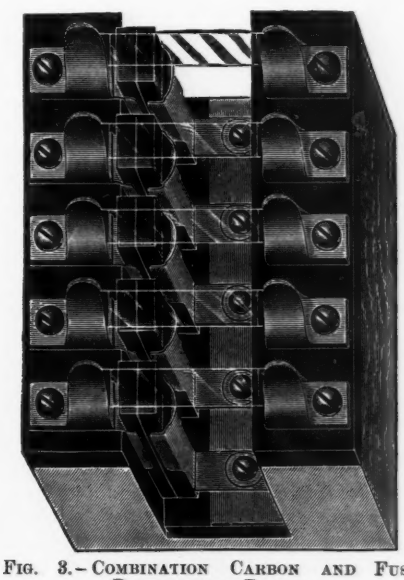


FIG. 3.—COMBINATION CARBON AND FUSE DISTRIBUTING BOARD.

tions of any size and is used as an inside terminal board, the fuses being mounted, as shown, in positions above it.

Fig. 2 shows a carbon distributing board in which lines and cables can be distributed from both sides, no loop being necessary, and at the same time a reliable lightning arrester is obtained without the use of fuses.

Fig. 3 is a modification of the same style of board, fuses being combined with it and the same advantages of ability to cross-connect without crossing carbon and ground connections being manifest in it, as in the device shown in Fig. 2.

# INDUSTRIAL NOTES

*Dearborn Drug and Chemical Works,* Chicago, claims to have more than 10,000 boiler feed-waters which are being treated by Dearborn methods. It also makes a specialty of oils.

*The Belden-Larwill Electric Manufacturing Company,* Fort Wayne, Ind., says it is in good shape to supply the demand for arc lamps which comes in the early Fall. This lamp has gained an excellent reputation with the trade.

*The National Telephone Equipment Company,* Detroit, Mich., announces that it has purchased the patents and property of the Detroit Switchboard Company, Detroit. This latter company was the builder of the independent exchange at Detroit.

*Rob't L. McOuat,* dealer in electrical supplies, Indianapolis, has on hand a large stock of telephone and electrical supplies for prompt shipments, as well as a stock of Peerless fan motors for all voltages or circuits. Mr. McOuat reports business good in his locality.

*The Milwaukee Electric Company,* Milwaukee, Wis., makes special and standard motors for all purposes, and belted or direct-connected generators for power and lighting; the latter from one to 300 kilowatts. This company says it has had an excellent Summer business.

*The Richmond Conduit Company,* of Milwaukee, Wis., has recently sent to the electrical trade a circular describing the conduit tubing which it makes. The outside of the tube is coated by a new galvanic process. The lining is enamel. It will send circular on inquiry.

*The Consumers' Carbon Company,* Lancaster, Ohio, is now engaged in building its plant, which it hopes to have completed in November. General Manager Edmund Dickey expects to have one of the finest and the most modern carbon manufactories in the country.

*The General Incandescent Arc Light Company,* New York, has just opened an additional branch office at 57 Perin Building, Cincinnati, Ohio, where Mr. F. C. Colwell will be in charge. Mr. Colwell has heretofore covered the Cincinnati territory of the company's business from Cleveland.

*The Lea Arc Lamp Company,* of Anderson, Ind., has put upon the market this season a new arc lamp made for all circuits. It has several new ideas which it says make it artistic in design, light in weight and mechanically perfect. Its catalogues are ready and will be mailed to any address for the asking.

*The Electrolysisproof Conduit Manufacturing Company,* 605-606 Manhattan Building, Chicago, is placing on the market a new line of insulating materials, conduits, laterals, distributor box and post linings. This company's factory is at Blue Island, Chicago, and Mr. W. F. McCarthy is general manager.

*The Crown Woven Wire Brush Company,* Salem, Mass., announces that users of its Crown commutator compound, in connection with its well-known woven wire brush, insure a large saving on the wear and tear of the dynamo or motor and prevent sparking, which is so detrimental to economical work. The company is in receipt of orders for the above-mentioned material and announces that it is running to its full capacity in order to fill the orders received.

*The L. B. Allen Company,* Chicago, manufacturer of the Allen soldering stick for electrical work, in a recent communication says that its business shows a steady and constant increase. It also mentions that in a recent letter received from one of Chicago's leading electrical supply houses the following quotation appeared: "We have tested the Allen soldering stick in paste form and are satisfied that it is all right," and that this was immediately followed by an order for an immense quantity of the Allen goods.

*The Diesel Heat Engine,* which has been fully described in a former number of the ELECTRICAL REVIEW, has been awarded the "Grand Prix" in the class of gas and petroleum motors at the Paris Exposition. This is the the highest award that could have been given and it shows the important place which the Diesel engine is acknowledged to hold in the field of gas and petroleum motors. Since the latter are destined to play an important part as a power source for electric lighting, the above information will be of interest.

*The Flint Eddy and American Trading Company* is the name of a new corporation consisting of the consolidation of Messrs. Flint Eddy & Company and the American Trading Company. This concern has branch houses and correspondents in England, Germany, Japan, China, Siberia, Philippine Islands, Brazil, Argentina, Chili, Peru, and other South American countries, Cuba, and the other West India Islands, Mexico, South Africa, Australia, and New Zealand, the Straights Settlements, India, and Burmah; and the two houses now composing it have long been well known in the American export trade.

*The J. G. Brill Company,* Philadelphia, Pa., street car and truck builders, advises us that the validity of its patent has been maintained, which permits of combining with the frames of the truck and spiral springs another class of springs, *viz.,* elliptical springs, between the car body and the extensions of the independent frames, and that the addition of other springs to the frame outside of the elliptical spring likewise does not avoid the charge of infringement; also that the decision covers any arrangement of spiral and elliptical springs placed on the outer end of the truck frames.

*The Eureka Electric Company,* Chicago, is forwarding without charge to independent telephone companies, a new name plate sign to go on the front of the instrument. The design embraces the well-known Eureka Maltese cross. The Eureka Electric Company will be pleased to mail or express as many of these name plates as may be desired to any of the independent companies in the field, for the purpose of attaching to telephones in exchanges. The words "Independent System" are added in connection with this design, and will no doubt prove a good idea to educate the general public to the use of the independent systems.

*The American Electric Telephone Company,* of Chicago, reports a large volume of business, especially in the line of multiple and central energy switchboards, contracts having recently been closed for several large installations, including Terre Haute, Ind., where the total contract price for all apparatus including full equipment of central office and subscribers' telephones aggregated nearly $60,000. Raleigh, N. C., Rome, N. Y., Fostoria, Portsmouth and Massillon, Ohio, Lansing and Adrian, Mich., are also on the list of large contracts. This company is making a feature of its new and improved protector devices, *i. e.,* the Burns inside cable terminal with carbon lightning arresters and heat-coil, sneak-current protectors, also the Burns individual telephone protectors, which are being very largely used. They are claimed to be the most economical as well as the most efficient protector devices on the market. The American express telephone switchboard is still gaining in popularity. The output of this type of switchboard alone averages over 1,000 drops weekly. A new competition switchboard known as the "New Universal" will be ready for the market from this factory shortly.

*The Manhattan General Construction Company,* Newark, N. J., advises us that in spite of the fact that the month of July ordinarily is a poor month for arc lamp sales, its orders for July, 1900, exceeded the orders for any past month in the experience of the company, extending through a period of seven years. The Manhattan series alternating-current system is receiving the general indorsement of discriminating electricians of high repute and is being very widely installed. We also learn that this company has received the following orders recently: Evanston Electric Illuminating Company, Evanston, Ill., 211 lamps; Fairport Electric Company, Fairport, N. Y., 60 lamps; W. M. Sheehan & Company, Wappinger Falls, N. Y., 52 lamps; Hagerstown Municipal Plant, Hagerstown, Md., 117 lamps; Town of Phillippi, W. Va., 20 lamps; Urbana Light, Heat and Power Company, Urbana, Ill., 78 lamps; New York, New Haven & Hartford Railroad, Hartford, Ct., 50 lamps; Hamilton Electric Light and Power Company, Hamilton, Ont., 200 lamps. In addition to shipping 350 series alternating-current lamps to the Northern Ohio Traction Company, of Akron, Ohio, it has received this company's order for 350 multiple alternating-current enclosed arc lamps.